
Book Reviews

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- 1 Advances in FDTD Computational Electrodynamics Photonics and Nanotechnology**
by: A. Taflove, Editor, A. Oskooi and S.G. Johnson, Co-editors
Published 2013
by Artech House, Boston, London, 685 Canton Street
Norwood, MA 02062, USA, 623pp
ISBN-13: 978-1-60807-170-8

Advances in photonics and nanotechnology have the potential to revolutionise humanity's ability to communicate and compute. To pursue these advances, it is mandatory to understand and properly model interactions of light with materials such as silicon and gold at the nanoscale (i.e., the span of a few tens of atoms laid side by side). These interactions are governed by the fundamental Maxwell's equations of classical electrodynamics, supplemented by quantum electrodynamics.

This book presents the current state of the art in formulating and implementing computational models of nanoscale optical interactions, where Maxwell's equations are solved using the finite-difference time-domain (FDTD) technique, pioneered by the senior editor, and its variant, the pseudospectral time-domain (PSTD) technique. Engineers can discover the most important advances in all areas of FDTD and PSTD computational modelling of electromagnetic wave interactions.

This cutting-edge resource helps professionals understand the latest developments in computational modelling of nanoscale optical microscopy and microchip lithography. Readers also explore cutting-edge details in modelling nanoscale plasmonics, including non-local dielectric functions, molecular interactions and multilevel semiconductor gain. Other critical topics include nanoscale biophotonics, especially for detecting early-stage cancers, and the quantum vacuum, including the Casimir effect and blackbody radiation.

The book contains the following chapters:

- parallel-processing three-dimensional staggered-grid local-Fourier-basis PSTD technique
- unconditionally stable Laguerre polynomial-based FDTD method
- exact total-field/scattered-field plane-wave source condition
- electromagnetic wave source conditions
- rigorous PML validation and a corrected unsplit PML for anisotropic dispersive media

- accurate FDTD simulation of discontinuous materials by subpixel smoothing
- stochastic FDTD for analysis of statistical variation in electromagnetic fields
- FDTD modelling of active plasmonics
- FDTD computation of the non-local optical properties of arbitrarily shaped nanostructures
- classical electrodynamics coupled to quantum mechanics for calculation of molecular optical properties: an RT-TDDFT/FDTD approach
- transformation electromagnetics inspired advances in FDTD methods
- FDTD modelling of non-diagonal anisotropic metamaterial cloaks
- FDTD modelling of metamaterial structures
- computational optical imaging using the finite-difference time-domain method
- computational lithography using the finite-difference time-domain method
- FDTD and PSTD applications in biophotonics
- GVADE FDTD modelling of spatial solitons
- FDTD modelling of blackbody radiation and electromagnetic fluctuations in dissipative open systems
- Casimir forces in arbitrary material geometries
- Meep: a flexible free FDTD software package.

The book is meant for academic and industrial researchers working on photonics and nanotechnology. It reviews the current state of the art in formulating and implementing computational models of optical interactions with nanoscale materials structures.

2 A Student's Guide to Fourier Transforms with Applications in Physics and Engineering, Third Edition

by: J.F. James

Published 2012

by Cambridge University Press, The Edinburgh Building

Cambridge CB2 8 RU, UK, 146pp

First published 1995, second edition 2002, third edition 2011

reprinted 2012, ISBN: 978 0521 17683 5 (pbk)

Fourier transform theory is of central importance in a vast range of applications in physical science, engineering and applied mathematics. Providing a concise introduction to the theory and practice of Fourier transforms, this book is invaluable to students of physics, electrical and electronic engineering and computer science.

After a brief description of the basic ideas and theorems, the power of the technique is illustrated through applications in optics, spectroscopy, electronics and telecommunications. The rarely discussed but important field of multi-dimensional Fourier theory is covered, including a description of computerised axial tomography

(CTA) scanning. The book concludes by discussing digital methods, with particular attention to the Fast Fourier Transform and its implementation.

This new edition has been revised to include new and interesting materials, such as convolution with sinusoid, coherence, the Michelson stellar interferometer and the van Cittert-Zernike theorem, Babinet's principle and dipole arrays.

The book contains the following chapters:

- physics and Fourier transforms
- useful properties and theorems
- applications 1: Fraunhofer diffraction
- applications 2: signal analysis and communication theory
- applications 3: interference spectroscopy and spectral line shapes
- two-dimensional Fourier transforms
- multi-dimensional Fourier transforms
- the formal complex Fourier transform
- discrete and digital Fourier transforms.

**3 Advance in Materials Science and Engineering,
Aerospace Materials Handbook
by: S. Zhang and D. Zhao
Published 2012
by CRC Press, Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300, Boca Raton
FL 33487-2742, USA, 781pp
ISBN: 978-1-4398-7329-8**

The *Advance in Materials Science and Engineering* series by CRC Press/Taylor & Francis Group is designed to help meet new and exciting challenges in materials science and engineering disciplines. The books and monographs in the series are based on cutting-edge research and development, and thus are up-to-date with new discoveries, new understanding and new insights in all aspects of materials development, including processing and characterisation and applications in metallurgy, bulk or surface engineering, interfaces, thin films, coatings and composites, just to name a few.

Flying a machine into the sky requires tremendous thrust and power to launch and sustain the flight, be it an airplane or a space shuttle. The engine thus needs 'superalloys' to function properly at extreme temperatures as high as over 1000°C and the body of the flying machine needs lightweight yet strong materials thus the need for new materials arises such as polymer composites and magnesium alloys. Materials used for aeronautical and aerospace applications are perhaps one of the most advanced materials of any time, owing to its harsh application environment and the most stringent safety requirements. Since the Wright Brothers over a 100 years ago, the aviation landscape has changed tremendously, and so have the materials used to make that happened. With the development of superalloys that work at even higher temperatures with even lighter

weight, we can expect faster and more powerful airplanes for passenger, cargo and all air or space applications.

This book covers traditional superalloys and recent development and applications of light alloys such as magnesium alloys and aerogel materials. It provides a timely handbook for seasoned researchers as well as newcomers in the aerospace materials field.

This book contains the following chapters:

- superalloys for super jobs
- tool condition monitoring in machining superalloys
- laser cladding and alloying for aerospace applications
- high-performance wear-/corrosion-resistant superalloys
- high-temperature oxidation of aerospace materials
- thermal spray coating for aeronautical and aerospace applications
- nanostructured solid lubricant coatings for aerospace applications
- processes and characterisation of metal matrix composites
- processing science for polymeric composites in aerospace
- carbon nanotube-reinforced polymer composites for aerospace applications
- emerging technology in aerospace engineering: polymer-based self-healing materials
- preparation and processing of magnesium alloys
- fatigue of magnesium alloys
- aerogel materials for aerospace.

4 Biomaterials Science: An Integrated Clinical and Engineering Approach
by: Y. Rosen and N. Elman
Published 2012
by CRC Press, Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300, Boca Raton
FL 33487-2742, USA, 309pp
ISBN: 978-4398-0404-9 (Hardback)

Going far beyond the coverage in most standard books on the subject, *Biomaterials Science: An Integrated Clinical and Engineering Approach* offers a solid overview of the use of biomaterials in medical devices, drug delivery and tissue engineering.

Combining discussion of materials science and engineering perspectives with clinical aspects, this book emphasises integration of clinical and engineering approaches. In particular, it explores various applications of biomaterials in fields including tissue engineering, neurosurgery, haemocompatibility, BioMEMS, nanoparticle-based drug delivery, dental implants and obstetrics/gynaecology.

The book engages those engineers and physicians who are applying biomaterials at various levels to:

- increase the rate of successful deployment of biomaterials in humans
- lower the side-effects of such a deployment in humans
- accumulate knowledge and experience for improving current methodologies
- incorporate information and understanding relevant to future challenges, such as permanent artificial organ transplants.

Using a variety of contributors from both the clinical and engineering sides of the fields mentioned earlier, this book stands apart by emphasising a need for the often lacking approach that integrates these two equally important aspects.

This book contains the following chapters:

- introduction
- principles of clinical and engineering integration in haemocompatibility
- medical applications of micro-electro-mechanical systems
- nanoparticles to cross biological barriers
- biometrical, dental materials, and device retrieval and analysis
- biomaterials in obstetrics and gynaecology
- tissue engineering: focus on the musculoskeletal system
- regulatory challenges in biomaterials: focus on medical devices
- innovative product D
- development and technology adoption medical applications
- appendix: some examples of FAD-approved products.

5 Introduction to Power Electronics

by: P.H. Chappell

Published 2014

by Artech House, Boston, London, 685 Canton Street

Norwood, MA 02062, USA, 199pp

ISBN-13: 978-1-60807-719-9

This book contains a description of the characters of different types of power semiconductor devices and their application to power converter circuits. It has been written as an introductory text containing the useful concepts and building blocks that go into making a power converter operate successfully. Devices physics and manufacturing of semiconductors are deliberately not included, as these are detailed in other texts and are often studied separately. Some applications to power transmission, electric drives and medical equipment are included to illustrate the wide range of power electronics in both small- and high-power circuits. Power electronics for converters are housed in purpose-built cubicles and buildings. Smaller converters are found in domestic white goods and mobile devices. Large-scale power electronics and their optimisation are an important link in the distribution of renewable energy to domestic and industrial

environment. Smaller-scale power electronics are becoming increasingly important in the automotive industry as vehicle electrification and hybridisation become more widely adopted.

The design process for power electronics encompasses stages of conception, analysis, computer simulation and experimentation. During this process, calculations and theoretical simulations should interact with practical testing (The latter of which can be particularly exciting and enjoyable when the time comes to make that final connection of power to a new circuit; a moment often accompanied with some trepidation and sharp intake of breath!). Practical testing is undertaken with certain amount of caution because dangerous voltages and high currents (hot components) can be found in power systems. As well as the power components, both analogue and digital electronics form an integral part in turning on and off power semiconductor devices to divert currents at different times to different parts of a power converter circuit. Electronics are also used to measure current, voltage and power in the control and testing of power electronics. Digital electronics are used to make logical decision in the operation of a converter and in the implementation of control algorithms. The book reflects this desire to present the fundamental art of power electronics and that the text encourages readers to seek out and use the latest devices in the design of novel power electronic circuits.

6 Polymer Processing: Principles and Design

Second Edition

by: D.G. Baird and D.I. Collias

Published 2014

by John Wiley & Sons, Inc. Hoboken, New Jersey

111 River Street, Hoboken, NJ 07030-5774, USA

Published simultaneously in Canada, 239pp

ISBN: 978-0-470-93058-8

With its emphasis on core principles, this text equips readers with the skills and knowledge to design the many processes needed to safely and successfully manufacture thermoplastic parts. The first half of the text sets forth the general theory and concepts underlying polymer processing, such as the viscoelastic response of polymeric fluids and diffusion and mass transfer. Next, the text explores specific practical aspects of polymer processing, including mixing, extrusion dies and post-die processing. By addressing a broad range of design issue and methods, the authors demonstrate how to solve most common processing problems.

This *Second Edition* of the highly acclaimed *Polymer Processing* has been thoroughly updated to reflect current polymer processing issue and practice. New areas of coverage include:

- micro-injection moulding to produce objects weighing fraction of a gram, such as miniature gears and biomedical devices
- new chapter dedicated to the recycling of thermoplastics and the processing of renewable polymers

- life-cycle assessment, systematic method for determining whether recycling is appropriate and which form of recycling is optimal
- rheology of polymers containing fibres.

The book contains the following chapters:

- importance of process design
- Isothermal Flow of Purely Viscous Non-Newtonian Fluids
Design problem I Design of a Blow Moulding Die
- Viscoelastic Response of Polymeric Fluids and Fibre Suspension
Design problem II Design of a Parison Die for a Viscoelastic Fluid
- Diffusion and Mass Transfer
Design problem III Design of a Dry-Spinning System
- Non-isothermal Aspects of Polymer Processing
Design problem IV Casting of Polypropylene Film
- Mixing
Design problem V Design of a Multilayered Extrusion Die
- Extrusion Dies
Design problem VI Coextrusion Blow Moulding Die
- Extruders
Design problem VII Design of Devolatilisation Section for a Single-Screw Extruder
- Post-die Processing
Design problem VIII Design of a Film Blowing process for Garbage Bags
- Modelling and Forming
Design problem IX Design of Compression Moulding Process
- Process Engineering for Recycled and Renewable Polymers
- Appendix A Rheological data for Several Polymers Melts
- Appendix B Physical Properties and Fraction Coefficient for Some Common Polymers in the Bulk State.
- Appendix C Thermal Properties of Materials
- Appendix D Conversion Table
- Index

Chapters feature problems sets, enabling readers to assess and reinforce their knowledge as they progress through the text. There are also special design problems through the text that reflect real-world polymer processing issues. A companion website features numerical subroutines as well as guidance for using MATLAB, IMSL and Excel to solve the sample problems from the text. By providing both underlying theory and practical step-by-step guidance, *Polymer Processing* is recommended for students in chemical, mechanical, material and polymer engineering.

Finally, the book has evolved out of teaching a senior-level course in polymer processing at Virginia Tech, the teaching of numerical methods to undergraduate chemical engineers and consulting experiences. First, it was apparent that reinforcement of transport phenomena was needed before one could begin to teach polymer processing. Second, it was recognised that BS Engineers are required to deliver answer and do not have time to weight out all various perturbations in various theories. Third, undergraduate engineers are becoming computer literate and have less fear of using computers than many professors. With these ideas in mind, we tried to write a book on polymer processing, which provides the necessary tools to do design calculations and at the same time informs the student exactly what he or she can be expected to do with the level of material at hand.

7 Corrosion Engineering

by: V. Cicek

Published 2014

by Scrivener Publishing, 100 Cummings Center

Suite 541J, Beverly, MA 01915-6106

Co-published by John Wiley & Sons, Inc., Hoboken, New Jersey, 266pp

ISBN: 987-1-118-72089-9

Corrosion costs billions of dollars to each and every single economy in the world. Corrosion is a chemical process, and it is crucial to understand the dynamics from a chemical perspective before proceeding with analyses, designs and solutions from an engineering angle. The opposite is also true in the sense that scientists should take into consideration the contemporary aspects of the issue as it relates to daily life before proceeding with specifically designed theoretical solutions. *Corrosion Engineering* is recommended to both theoreticians and practitioners of corrosion study alike.

Corrosion engineering is a joint discipline associated primarily with major engineering sciences such as chemical engineering, civil engineering, petroleum engineering, mechanical engineering, metallurgical engineering and mining engineering. Corrosion engineering also plays a fundamental role in scientific discipline such as chemistry, physics, biology and microbiology.

Corrosion Engineering is a must-have reference book that covers the corrosion process with respect to both its scientific and its engineering aspect. It is also a valuable textbook that can be used in engineering or scientific courses on corrosion at the university level.

The book contains the following chapters:

- corrosion of materials
- cost of corrosion
- factors influencing corrosion
- corrosion mechanisms
- types of corrosion
- the thermodynamics of corrosion

- corrosion prevention and protection
- corrosion and corrosion prevention of concrete structures
- corrosion and corrosion prevention of metallic structure and seawater
- corrosion and corrosion prevention in petroleum industry
- corrosion and corrosion prevention in water transportation and storage industry.

Some of the benefits included in *Corrosion Engineering*:

- The theory of corrosion is given with a broad definition of corrosion, including factors affecting the corrosion processes in and types of corrosion, based on corrosion mechanism and the media along with characteristics of metal alloys are commonly used and liable to corrosion.
- The nature of protective metal oxide films are explained along with aggressive chemical anions that disintegrate these metal oxide film.
- Major corrosion prevention methods are explained that are anodic and cathodic chemical inhibitors and protective coatings.
- Corrosion prevention method in engineering sciences such as cathodic protection is discussed with a focus on steel and concrete structures that relate to mostly civil and petroleum engineering.

Corrosion science engineers, chemist and chemical engineers, material scientists, civil engineers, petroleum engineers, metallurgical engineers, mechanical engineers, mining engineers, agricultural engineers and electrical engineers may benefit from the content within this book. It is also a must-have for students and professors in engineering, materials and chemistry.

8 Guide to Building Control for domestic Buildings

by: A. Gwynne

Published 2013

by Wiley–Blackwell, A John Wiley & Sons, Inc.

Hoboken, New Jersey, 328pp

ISBN: 978-0-470-65753-9 (pbk.)

To clarify the practical requirements of the Building Regs and help you meet their requirements first go, all the information in the Building Regulations 2010 and Approved Documents is presented here in an easy-to-understand format, clear, concise and fully illustrated.

Guidance is given for domestic buildings of up to three storeys in England and Wales, including extensions, loft conversions, new dwellings, conversions (garages, basements and barns) and upgrading of existing buildings – including the use of natural lime mortars, plasters renders and paints. There are clear explanations of how the technical design and construction requirements of Building Regs be met with sufficient information to draw up an effective specification and design to be developed.

Guide to Building Control illustrates the design and construction of the various building elements and explains the principle and process of the Building Regulations and Approval Documents – including structure, fire safety, contaminants, sound insulation, ventilation, water efficiency, drainage systems, combustion application, stairs and guarding, energy conservation/green building issues, disabled access, safety glazing, electrical safety, materials and workmanship.

The Guide contains up-to-date examples of everyday practice and produces gained by the author – a practising building control surveyor – from years of responding to requests from property professions, builders, property owners and students for clarification of the practical requirements of the Building Regulations.

Accompanied by detailed diagrams, tables and text offering an enlightened understanding of the complexities of regulations, the Guide is both an authoritative reference for use at planning stage and a practical handbook on site.

Students and professionals will find it an essential, easy-to-use resource for building control surveyors, building designers, building contractors, self-build and other working in the construction industry.