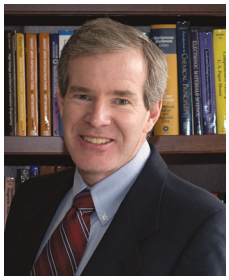
Book Reviews



John J. Shea

Optical Engineering Science

S. Rolt
John Wiley & Sons Inc.
111 River Street
Hoboken, NJ 07030
http://www.wiley.com
ISBN 978-1-119-30280-3
656 pp., €115 (Hardcover), 2020

This book provides a comprehensive review of optical engineering. It contains a blend of fundamental theory with practical commercial applications that gives the reader the immediate satisfaction of understating the technical operation of many optical devices in use today such as cameras, spectrometers, and telescopes, just to name a few applications. The book also covers many optical engineering equipment and methods used to measure and characterize optical devices and equipment.

The first part of the book covers descriptions of fundamental theory and components and their use in typical optical systems. Some of the items covered include a review of geometrical optics and definitions, apertures and stops, aberrations, and aberration theory, diffraction, radiometry and photometry, and polarization. These are all essential theories and methods that provide the reader with a solid background in optical engineering principles.

Next, optical material are introduced. Fundamental principles of the effects of materials on optical radiation are explained along with coating, filters, prisms, and dispersion devices. Materials are a key parameter for many critical applications, and this section guides the reader toward an understanding of the material effects on optical radiation and how to choose the correct optical materials for an application.

Lasers and laser applications along with optical fibers, waveguides, and detectors are then introduced. One area that may be of particular intertest to our readers who work with optical fibers is methods to efficiently couple an optical signal to a fiber optic cable.

Details such as the differences and advantages and disadvantages of various imaging devices such as telescopes and microscopes are useful for anyone contemplating purchasing or building one of these instruments to help with a selecting the type of the intended application. Other devices also described are interferometers, spectrometers, and related equipment. All the fundamental technical details provided on these devices will greatly assist the reader in understating their design and function and provide information for choosing the proper instrument.

Other topics, including the optical lens design process, mechanical modeling, optical component manufacture, system integration and alignment, and optical test and verification, bring together information for developing an entire optical system, not only the optical components. This reference design will help those looking for information or processes on what is involved to develop an overall optical system including recommended design guidelines.

This comprehensive reference volume is written for optical engineers, optical designers, optical systems engineers, and students looking for a design reference that covers a broad range of optical design and optical metrology topics and applications. The book has a dedicated website, accessible with the provided QR code (which may require an account with Wiley to access), that includes problem solutions and spreadsheet tools, making it suitable for a course in optical engineering and a quick way to develop and test your own designs with example spreadsheets already developed.

LPWAN Technologies for IoT and M2M Applications

B.S. Chaudhari and M. Zennaro, Editors
Elsevier
50 Hampshire Street, 5th Floor
Cambridge, MA 02139
http://www.elsevier.com/books-and-journals
ISBN 978-0-12-818880-4
445 pp., $125 (Softcover), 2020

Low-power wide area network (LPWAN) is a promising solution for long-range low-power Internet-of-Things (IoT) and machine-to-machine (M2M) communications. The idea of implementing sensors thorough out devices such as instrumentation, electrical networks, or things in remote locations, in which you want to monitor and measure various parameters, allows for autonomous control and predictive maintenance. However, usually, there are resource-limited constraints (e.g., no power sources) for these sensors, which then require a battery and some means of energy harvesting or power supply to charge the battery or power the sensor. This necessitates the need for very-low-powered devices. But even then, the sensors still need a power source, and the longer the transmitting range desired, the higher the power requirements. Batteries have a limited charge life and need to be recharged. LPWAN devices and network architecture are designed to meet these requirements.

This book provides comprehensive coverage of LPWAN and IoT technologies. It focuses on design requirements and constraints; channel access; spectrum management; collisions and inter-

ference; energy efficiency, use cases and applications; cyber-security, hardware, and software platforms; issues; and future directions.

Specific topics cover an introduction to LPWAN and network topologies and currently used solutions and design considerations. LoRaWAN (Long-range wide-area network) protocol and challenges of this technology are discussed. The Sigfox radio system, ultra-narrowband technology, is also introduced. Application topics cover IoT concepts and deployment challenges along with the evolution of M2M communications. Methods for energy optimization are reviewed for LPWAN including energy harvesting (mainly focused on harvesting RF transmission signals) and relaying sensor network used to increase transmitting range without higher power sensor transmitters. Guidelines and criteria for selecting the optimal LPWAN technology are also presented. Other topics include wearable LPWAN devices for remote health monitoring, using LoRa, edge, and fog computing methods for traffic monitoring, cyber-security, and various LPWAN hardware and software platforms currently available.

This book is a very good introduction and easily accessible way to learn about the upcoming technology of LPWAN. It would help teachers, students, researchers, and industry professionals to quickly understand LPWAN technologies, design networks, and deploy IoT applications.

Advances in Modern Sensors: Physics, Design, Simulation and Applications

G. R. Sinha, Editor
IOP Publishing Ltd.
Temple Circus, Temple Way
Bristol, BS1 6HG, UK
Phone: +44 (0)117 929 7481
USA Office:
190 North Independence Mall West, Suite 601
Philadelphia, PA 19106, USA
Phone: +01 215 627 0880
http://store.ioppublishing.org
ISBN 978-0-7503-2707-7
143 pp., $159 (eBook), 2020

There are many books on sensors but this one highlights the applications of modern sensors such as wearable sensors, wireless sensors, and cognitive sensors. It presents an introduction and overview of sensors and technologies with an emphasis on modern sensor technology including fundamentals, background, and theoretical concepts of sensors case studies. It covers classification of sensors; some applications of optical sensors; chemical sensors; calibration of optical imaging sensors; wearable sensors; cognitive and biosensors; and sensors used in self-driving cars.

The book begins by introducing a set of definitions for parameters used for describing the properties and characteristics of sensors in general. This information does not seem to apply to any particular sensor and is more of an introduction, but it does not provide any specific information. Classification of sensors follows. Here sensors are generally classified to identify the type of sensor used for a desired application. Also discussed are important attributes such as accuracy versus precision with regard to sensors. The optical sensor sections describe some photo-sensors and optical fibers with a focus on IR sensing and visual imaging. The possibilities of various wearable sensors are described such as sensors for human health assessment, but no specific details on actual sensors are presented. A walking stick for the visually impaired is presented, which uses an Arduino Uno board to illustrate the possibilities of incorporating various sensors in a walking stick intended to help guide the visually impaired. Sensor technology used for self-driving cars provides a general overview that discusses the technology basics and the sensors incorporated in a system but, again, with little design or sensor details.

The book may be of interest to a wide spectrum of readers, such as research scholars, academia, and industry professionals. It is especially for those who employ smart sensors for emerging applications such as robotic arms, cognitive applications, and brain–computer interfaces who may want an overview to gather general ideas for a certain technology that employs modern sensors.

Handbook of Magnetic Materials, Volume 29

E. Bruck, Editor
North-Holland
Radaweg 29, PO Box 211
1000 AE Amsterdam, the Netherlands
Distributed by:
Elsevier Inc.
50 Hampshire Street, 5th Floor
Cambridge, MA 02139
http://www.elsevier.com/books-and-journals
ISBN 978-0-12-821023-9
213 pp., $385 (Hardcover), 2020

This handbook is part of an on-going series in magnetics; this is the 29th volume in this series. This volume provides updates on select cutting-edge research in magnetics. This particular volume describes three technology areas currently being researched, primarily for the emergent energy transition.

The first of these areas introduces magnetic materials using the concept of spin-orbital torques, originating from the transfer of orbital angular momentum from the lattice to the spin system. This work involves topological insulators and Dirac fermions. Applications envisioned include data storage and the generation of microwaves for wireless communications.

The second class of magnetic materials described covers the effect of magneto-electric coupling between magnetic and electric fields in a material. This effect creates a magnetization of a material proportional to an applied electric field and vice versa. Potential applications include energy transformation, signal generation and processing or information storage. Authors discuss requirements for such materials and the existing challenges and potential processing methods to overcome such limitations in order to realize such applications.

The third topic provides an update on the current state of magnetocaloric materials. The fundamentals for thermodynamics are reviewed as well as the peculiarities associated with magnetic phase transitions in these materials. Envisioned potential applications of these types of

materials could include energy efficient magnetic refrigeration.

Although widely accessible, this book is primarily intended for material scientists studying emerging magnetic materials with an interest in the three areas described. The book is highly illustrated with many graphs, tables, and figures summarizing the latest research results in these three areas with accompanying explanations and many references for further study. Those working with these types of materials would certainly find this update of interest.

Contact Lines for Electrical Railways—Planning, Design, Implementation, Maintenance, 3rd Edition

F. Kiessling, R. Puschmann, A. Schmieder, and E. Schneider
Publicis Publishing
Erlangen, Germany
Distributor:
Wiley-VCH GmbH
PO Box 10 11 61,
69451 Weinheim
Boschstrasse 12,
69469 Weinheim
Germany
Phone: +49 (0)6201/606-0
http://www.wiley-vch.de
ISBN 978-3-89578-420-0
1104 pp., 129 € (Hardcover), 2018

Electric railways use overhead electric lines to provide power to electric trains. These types of trains are very common in much of Europe, parts of Russia, China, and Japan and many other countries but are used in very limited locations in the USA. They are typically found in dense urban areas or used to connect large cities. Typically, overhead lines carry electric current to the railcars to power the system. Both AC and DC systems are used with voltages typically ranging from 750 V_{dc} to 3 kV_{dc} and 15 kV_{ac} to 25 kV_{ac}. The previous editions of this book have become worldwide reference standards for contact line engineering including the details for planning, design, implementation, and maintenance of contact lines for electric railway systems.

The authors, active or former Siemens employees or from the Powerlines Group, from Germany and Austria, have extensive experience in contact line technology. This book covers all aspects of contact lines with topics covering the following areas: an overview of the electric power systems feeding the electric trains; an introduction to the history of power transmission to railways; all electrical and mechanical aspects of overhead rail design; the interaction between contact lines and pantographs especially at high speed; safety aspects; component descriptions; contact line planning and layout; the construction and maintenance of contact lines; and relevant IEC and Cenelec standards.

This handbook provides a very comprehensive reference source for all aspects of contact lines for electric railways. Because the majority of electrical railways are in countries predominantly using IEC standards and the authors are from Europe, the book focuses on those types of systems, which covers the majority of systems in the world. If you have any involvement or interest in contact lines for electric railways, then this book would be an excellent reference choice that could be used for many years.

Introduction to Simulation Methods for Gas Discharge Plasmas: Accuracy, Reliability and Limitations

I. Rafatov and A. Kudryavtsev
IOP Publishing Ltd.
Temple Circus, Temple Way
Bristol, BS1 6HG, UKUS
Phone: +44 (0)117 929 7481
USA Office:
190 North Independence Mall West, Suite 601
Philadelphia, PA 19106, USA
Phone: +01 215 627 0880
http://store.ioppublishing.org
ISBN 978-0-7503-2360-4 (eBook)
61 pp., $159 (eBook), 2020

This introductory book on numerical modeling methods for gas discharge plasmas is intended to help graduate students and scientists working in the area of computational plasma physics, model plasmas.

Plasma fluid equations, in the drift–diffusion approximation, are derived from the kinetic Boltzmann equation. The essentials of basic modeling approaches (fluid, particle, and hybrid) for gas discharges are described along with details to implement these methods. Some examples of DC and RF glow discharges are given to illustrate the methods. The basics of the finite-difference method and a systematic description of the finite volume method for the numerical solution of the spatially one-dimensional drift–diffusion equation are given. A numerical investigation of nonlinear dynamics and spatial-temporal pattern formation in the gas discharge system with a semiconductor cathode is also presented.

If you model low-pressure (nonthermal) plasmas, this book will provide the fundamental equations that can be used to simulate various aspects of the low-pressure plasma. You will also learn about the physics behind the equations through explanations and graphical plots of results including comparisons between simulations and experimental results. The reader would need a background in plasma physics and some familiarity with Boltzmann's equation to fully appreciate this book.