Book Reviews

John J. Shea

Mechanical Design Engineering Handbook, 2nd Edition

P. R. N. Childs
Butterworth-Heinemann
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Cambridge, MA 02139
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This book presents an overview of the mechanical design process and covers the design, specification, selection, use and integration of the machine elements that are fundamental to a wide range of engineering applications. This updated edition includes new material on tolerancing, alternative approaches to design, and robotics, as well as references to the latest ISO and US engineering regulations.

This practical reference handbook for mechanical design is very useful for understanding the fundamentals of mechanical elements. For example, there are descriptions of many different types of fasteners and equations used to describe each type of fastener such as screw pitch, and the terms used to describe a screw and the various types of screws. There are a variety of mechanisms described and the equations and expected behavior for the mechanism along with many practical tips for designing the best possible mechanical element.

Advanced Materials for Electromagnetic Shielding—Fundamentals, Properties, and Applications

M. Jaroszewski, S. Thomas, and A.V. Rane, editors
John Wiley & Sons Inc.
111 River Street
Hoboken, NJ 07030
http://www.wiley.com
455 pp., $225 (Hardcover), 2019

Electromagnetic shielding may be necessary for protecting sensitive electronic circuits and people from electromagnetic fields. This book reminded me of a classic book on Grounding and Shielding Techniques, by Ralph Morrison, which focused on the fundamentals of identifying and measuring EMI/RFI. While this book has a few chapters on the fundamentals of shielding, it is primarily focused on shielding materials. These materials mainly cover various types of filled polymeric resins.

The book can be separated into three parts. The first part reviews the fundamentals of EMI/RFI shielding, with topics covering the fundamental theory of electrical and magnetic shielding, shielding effectiveness measurement methods, various field sensors, and the impact of EMI on human health and safety.

The second part of the book deals with composite shielding materials, including carbon nanotube and graphene/polymer composites, flexible and transparent materials using conductive polymers and nanocarbon, and textile based shielding materials. Methods are discussed for the fabrication of graphene and carbon nanotube based shielding materials as well as carbon nanofibers and silver nanowires composite materials. There is a plethora of data presented on the various types of shielding materials that include EMI shielding effectiveness for synthesized materials.

The third part covers applications, including shielding materials for aerospace (space-based), metamaterials fundamentals and fabrication for shielding applications, double percolating materials using carbon black and polymer blends, and mechanical performance characterization using optical techniques.

This is an interesting book for material scientists or engineers interested in developing plastic composite materials for electromagnetic shielding applications. Loads of data and material properties for state-of-the-art filled polymers can be used to possibly create a dual-purpose mechanical form which also acts as an EMI shield. This book will get you to think about the many possibilities to develop effective EMI/RFI shields for your application.


D. D. L. Chung
World Scientific Publishing Co.
5 Toh Tuck Link
Singapore 596224
US Office:
27 Warren Street
Suite 401-402
There are many forms of carbon each with their own unique set of properties which enable unique applications. For example, devices such as automobile body parts, sports equipment, and aeronautical components, made from carbon fiber, take advantage of its high strength and lightweight properties. Other forms of carbon, activated carbon, are used in filtering applications, taking advantage of the large surface area of this type of carbon. Other carbon types have differing properties and have also found many uses in other applications.

This book provides the most recent information on various forms of carbon. The book is organized by each chapter describing one type of carbon including graphite, carbon black, graphene, activated carbon, carbon fibers and carbon nanotubes/nanofibers. In each chapter, the author clearly describes the structure, properties (electrical and mechanical), fabrication methods, and applications for each type of carbon. Variants of each carbon type, if any, are also detailed. For example, the chapter on graphite covers pyrolytic graphite, polycrystalline graphite, intercalated graphite, graphitic oxide, turbo-stratic carbon, exfoliated graphite, and flexible graphite.

Details are also presented for the processing methods for each carbon type. The numerous illustrations make this book very useful for anyone attempting to make these materials. Common practices are illustrated along with details and illustrations of the equipment used to process the materials make this a very useful reference book for undergraduate and graduate materials science students.

**Optoelectronic Devices**

N. K. Dutta and X. Zhang
World Scientific Publishing Co.
5 Toh Tuck Link
Singapore 596224
US Office:

27 Warren Street
Suite 401-402
Hackensack, NJ 07601
http://www.worldscientificpress.com
584 pp., $168 (Hardcover), 2018

This book provides information on the advances in research, technology, and commercial trends in optoelectronic and optical fiber-based devices and systems. In-depth technical details are described concerning the design and application of optoelectronic devices including light emitting diodes (LED’s), semiconductor lasers, photodetectors, optical fibers, and solar cells. Some of the applications discussed are range from solid-state lighting, optical communication systems, fiber amplifiers, and fiber lasers for high power industrial applications.

The fundamental operating principles of semiconductor optical materials for the generation and absorption of light are described including LED’s and semiconducting lasers. Fabrication methods for infrared, visible and blue LED’s are covered along with performance characteristics of semiconducting lasers, the mechanisms for gain, threshold conditions, and optical gain spectrum calculations. Surface emitting lasers, used for optical interconnections between computer backplanes and quantum cascade lasers, are discussed. Also, since photodetectors are critical to communication systems, the principle of operation of two types of commonly used photodiodes, the P-i-N and avalanche photodiodes are also described. Other devices described cover optical amplifiers, photonic integrated circuits, optical fibers, planar waveguide amplifier and lasers, and optical transmission systems.

A very handy feature of this book includes an appendix section consisting of fifteen parts, each dedicated to listing equations and solution examples for calculating various important quantities for optoelectronic devices.

This book is an in-depth technical resource for understanding the principles of various types of optoelectronic devices and systems. Students, as well as working professionals, would find this book useful for calculating quantities needed in the design of optical system components. There is a section, at the end of the book, along with an extensive reference list at the end of each chapter, that provides problems from each chapter, making this book suitable for an undergraduate or graduate class in electrical engineering on optoelectronic theory.

**Distributed Control and Optimization Technologies in Smart Grid Systems**

F. Guo, C. Wen, and Y-D. Song
CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway - NW,
Suite 300
Boca Raton, FL 33487-2742
http://www.crcpress.com
213 pp., $155 (Hardcover), 2018

Microgrids (MG’s) can add a new degree of resiliency and security to a facility or power grid by utilizing renewable energy sources, energy storage, and different levels of controls. While the microgrid can either be connected to the existing AC power grid or islanded (i.e. disconnected from the power grid), one of the most crucial aspects of the MG is in the algorithms used to control the various parts of the MG. This book focuses on the control aspect of a MG. Rather than a centralized control strategy, this book describes a distributed three-layer control strategy consisting of the primary layer or component control, the secondary or “edge” control layer, and the tertiary or optimization layer. It is the combination of these control layers that define a MG and bring value to the end user.

This book contains three sections that describe these control layers. Descriptions for the fundamental theory are provided in each section that includes: technical details for each method, illustrations, example waveforms where appropriate, and references for more in-depth study.

The first section, while not getting into the details of specific components, describes voltage and current regulation methods, droop control, and the use of
virtual impedance to maintain desired operating conditions at the converter/inverter level. This primary control layer’s main function is to regulate the frequency and voltage output of converters/inverters.

The second section of the book describes the second or ‘edge’ control layer of the three-layer strategy. In this layer, frequency and voltage restoration and voltage quality enhancement control methods are detailed. MATLAB simulation results are used to illustrate control algorithm examples.

The third section (tertiary control layer), describes control theory methods used for optimizing power flow and economic dispatch. Optimal power flow methods are used to control system voltage and to prevent abrupt voltage fluctuations. Its main object is to minimize either power distribution losses or the cost of power from distributed generation while maintaining voltage regulation. Economic dispatch optimizes the power allocation among the energy sources in an economically efficient manner while meeting load demand and source constraints. Decisions such as when to draw power from the battery versus the grid and what loads to shed if the available sources are not available, the cost of power from the source, and other constraints are optimized using various control theory methods and pricing strategy methods.

This book provides a nice bridge between pure control theory and practical implementation of various control strategies for MG’s. It gives very good technical depth and illustrates the theory being implemented to provide the reader not only familiar with control theory, but those working with MG’s in general, with an accessible book on MG controls that ties control theory together with physical implementations making this book worthwhile reading not only for MG software developers, but for MG developers in general.

**Protective Grounding**

A. A. Zaky

Independent Publishing Network

Email inquiries to: aaizaki@yahoo.com


253 pp., $50 (Softcover), 2019

Proper grounding of electric power networks is critical for human safety and proper operation of many protective devices. This monogram provides technical details on various types of grounding methods and grounding safety practices generally based on IEC standards. While this book is intended to give the reader a better understanding and explanations for the reasons why certain grounding methods are implemented, each country and jurisdictions within each country may have very specific rules for grounding that must be followed. While not explaining specific standards, this book can help you to better understand the motivation for those standards by understanding the fundamentals of safety grounding.

The book begins by explaining the effect of current on the human body and the significance of resistance to ground and the factors that affect it. It goes on to describe methods for creating earthing electrodes for single rods, multiple rods, water pipes, and the effect of resistance area, materials used to surround the grounding rod, and touch voltages. Calculations are shown for determining touch voltages for a given fault current flowing in the ground. Grounding system examples (i.e. TT, TN-C, TN-S, IT, protective multiple earthing, and isolation) for power systems and computer systems are described. Substation grounding system design that includes ground mat resistance calculations, computer program designs of ground mats, and calculations for maximum touch and step voltages are also presented.

Further, a description of static charge electrification and methods used to minimize or prevent the effects of static charge are detailed. These include conditions for ignition of explosive gases, minimum ignition energies, static charge generation, and methods for reducing the formation of static charge build-up. There are also methods presented for minimizing the risk of damage when handling electronic components. Lightning protection is also covered. Various situations are described such as the types of down conductors, side flashing relative distance to hot water heaters, and protection zones. Calculations are given for estimating electric field potentials at protective grounding conductors to determine if the conductor will generate corona, thus attracting lightning.

This book gives the reader a very good understanding of the fundamentals of grounding systems and the nuances of various types of grounding systems without giving very specific details but with enough technical detail to understand the basics. While not specifically referencing standards, it shows the importance of following standards and standard practices to increase safety in power networks. It is a very handy book for those who may work with power system design including field engineers and electrical power engineers, who want to gain an understanding of the number of different types of grounding methods and the reasons behind each method.