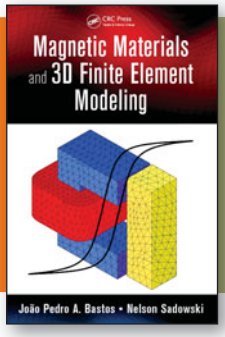


Magnetic Materials and 3D Finite Element Modeling

João Pedro A. Bastos
and Nelson Sadowski

CRC Press, 2013
382 pages, $119.96
ISBN 978-1-4665-9251-3

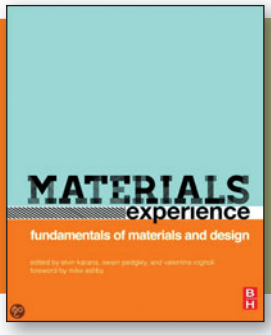
Finite element (FE) analysis has been widely used by engineers and researchers during the product development process of electromagnetic devices. For the design of the devices, both the modeling technique and precise description of the performance of the materials are essential, and both topics are covered in this book.

The book starts with Maxwell equations, which are the foundation for the topics that follow. From this point of view, the book aims primarily at graduate or senior undergraduate students who have taken introductory courses in electricity and magnetism and who have basic knowledge of vector analysis, linear algebra, and numerical analysis. The authors did excellent work to illustrate the equations. Relationships between different variables in the equations are presented with the help of simple schematic diagrams. The equations are explained in such a way that it is very easy for the readers to link them to the following FE calculation. For low-frequency applications, emphasized by the authors, permanent magnets and electrical steels are vital materials. Iron losses in electromagnetic devices are also addressed after a brief introduction to magnetic materials. Both experimental measurement procedure and theoretical hysteresis modeling (i.e., transition curve construction) are discussed. The latter is also essential for the following FE calculation.

Finite element modeling (FEM) is a broad topic. In this book, the authors focus on the Galerkin method, which is widely used in electromagnetism. Although the title of the book mentions three-dimensional (3D) finite element modeling, the authors introduce the fundamental concept and the method from 2D applications. The strategy here is similar to the way the Maxwell equations are presented, breaking down complex problems into smaller components. Fundamental concepts, such as Nodal elements, edge elements, shape functions, and coordinate transformations, are well explained. This approach provides a clear explanation for readers without any exposure to FEM. Simulation details are presented with original Fortran 77 codes. Most readers, especially beginners, may not need to write code, but writing computer programs is helpful to achieve a firm understanding of the underlying concept. The authors conclude the book with 3D magnetostatic and dynamic applications, a convenient way for readers to practice what they have learned in this book and to study the advanced topics in electromagnetic simulation.

Overall, this book is well organized and clearly written. However, the section on materials is too brief. In particular, typical permanent magnets are covered in less than one page, and recent developments of permanent magnets are not discussed. From this perspective, this book is more suitable for those who have expertise in magnetic materials and are seeking knowledge and skills in FE analysis.

***Reviewer: Wanfeng Li** is a research engineer in the Research & Advanced Engineering Department, Ford Motor Company, USA.*



Materials Experience: Fundamentals of Materials and Design

Editors: Elvin Karana, Owain Pedgley, and Valentina Rognoli

Butterworth-Heineman, 2013
400 pages, $69.95
ISBN 978-0-08-099359-1

This book gives an excellent introduction to a composition that reflects the fundamentals for turning a design idea into a materialized outcome. It provokes us to think more deeply about relationships we have with the materials of our world and how we could strengthen the materials and design arena.

The first section is concerned with the fundamentals of user experience. The contributing authors explore how people approach materials, how they sense them, how they attribute meanings to them, and how they build deeper relationships with them. The editors offer chapters on the role of materials in product experience, sensory pleasure, multisensory approaches that bring about materials experience, and universal and cultural meanings in relation to material aesthetics.

The second section discusses materials and design in relation to sustainability, covering the roles of materials and achieving social sustainability, emotionally durable design, and alternative design approaches, including designing with waste, design for imperfection, and graceful aging. The last chapter of this section presents a number of novel multipurpose materials with good environmental credentials.

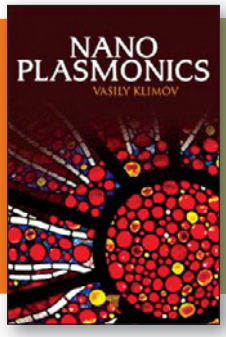
In the third section on Technological Development in Materials and

Manufacturing, the authors discuss novel approaches and technologies in the materials and design world. The fundamental technology-driven issues discussed in the materials and design domains are covered, alongside their effects on our daily experiences with materials and products. The design potential of new generations of smart, reactive, and multipurpose materials is discussed.

The fourth section presents the practical task of choosing one material over another. It includes diverse topics such as balancing functionality and expression through materials, ways of learning about material properties, and the development of new experiential-based materials selection tools and methods.

This book is very useful as a fundamental knowledge tool for materials experience and design. The editors have succeeded in doing this, and they piece each contribution into a good web with extraordinarily diverse competences and perspectives. I recommend this book to those interested in materials design, from those entering the field to professional researchers.

Reviewer: Jianguo Lu *is an associate professor at Zhejiang University, China.*



Nano Plasmonics
Vasily Klimov

Pan Stanford Publishing, 2014
581 pages, $142.45
ISBN 978-981-4267-16-8

Nanoplasmonics is a mature subfield of research in nanoscale optics. This book provides a comprehensive description of the plasmon oscillations that occur in metal nanoparticles. The book is written from materials science and physics aspects and comprises 14 chapters and 581 pages. The book is very well translated from Russian by Anna Sharonova.

In chapter 1, the author summarizes key advancements in the field and a number of papers published within the scope of surface plasmons. The contents in subsequent chapters are also outlined. The historical evidence on the existence of plasmonic nanoparticles is briefly discussed in chapter 2. Modern methods of nanoparticle synthesis are also described, including the precipitation from colloid solutions, the reverse micelle process, and the nanolithography approach. Chapter 3 uses electromagnetic equations to describe the propagation of light waves, optical properties of metals, and bulk plasmon properties of metals in the transparent region. Chapter 4 considers the surface plasmon waves propagating along metal–dielectric interfaces and other complex layered structures. Excitation methods and the observation of surface plasmons are also described.

After the introductory chapters, the theory of plasmon oscillation in nanoparticles is described in chapter 5. In chapters 6 to 9, the author introduces the "ε-method" to describe the optical properties of metal nanoparticles of an arbitrary shape and size. Particular emphasis is placed on the geometries of nanostructures (from spherical to multidimensional ellipsoids and polyhedral nanoparticles), which produce characteristic effects on their resultant plasmonic behaviors.

Chapter 10 in this book describes the plasmon oscillation of nanoparticle clusters consisting of two nanoparticles with various geometries. This is followed by the plasmon wave propagation along a chain of nanoparticles. Chapter 11 evaluates the optical properties of metamaterials, and chapter 12 discusses nanoholes in metal film as a counterpart of discrete nanoparticles. Finally, chapter 13 is devoted to discuss applications of nanoplasmonics in tumor therapy, biosensing, integrated circuits, superlenses and hyperlenses, and invisible cloaks prior to the conclusion in chapter 14. Two appendices on additional theory and numerical methods are also available.

This book provides comprehensive and systematic materials on nanoplasmonics with sufficient mathematical and conceptual description. Klimov fully describes the shape-dependent effects of nanoparticles. This book may be further improved with additional chapters that emphasize the interactions of nanoparticles with active (or nonlinear) medium or light emitters nearby. Discussion of more recent research work from various research groups would also enhance the value of the book. Overall, this book is very appropriate for graduate students, scientists, and engineers, either beginning to explore the field or already engaged in the research area. The scope of contents, quality of graphics, and clarity of the mathematical descriptions are very satisfactory to the reviewers. Therefore, we can recommend this book to readers who are interested in the field of nanoplasmonics.

Reviewers: Jae Yong Suh *and* ***Yoke Khin Yap*** *of Michigan Technological University, USA.*