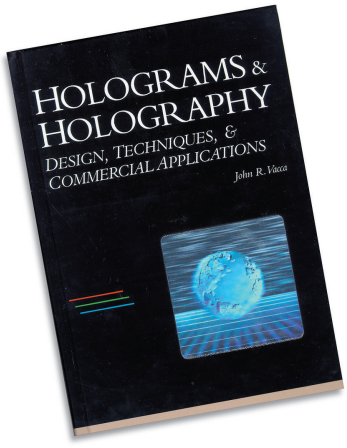


Holograms & Holography

John R. Vacca
Charles River Media, Inc., 1998
ISBN 1886801967
676 pages, $59.95 (hardcover)

REVIEWED BY JAMES C. WYANT

As we all know, holography is a fascinating subject that probably has not been the source of the great applications expected of it in the 1960s when it first became popular, but over the years has yielded several useful applications in fields such as security, displays, and holographic nondestructive testing. Perhaps the greatest application of holography has been as an aid in recruiting young people into optics. How can anyone look at a hologram and not get excited about optics!

The introduction to this book states that its purpose "is to show experienced (intermediate to advanced) holography professionals how to design and create holographic applications for experimental, commercial, military, and private use." To achieve this goal, the book is organized into seven parts, including the appendices. These seven parts are: overview of hologram technology and practical uses; commercial applications; integral and portrait holography; computer-generated holography; electro- and electron holography; custom holography, security, results, and future directions; and, the appendixes. Included is a CD with copies of the figures, some animations, and copies of Web sites. Two holograms are also included.

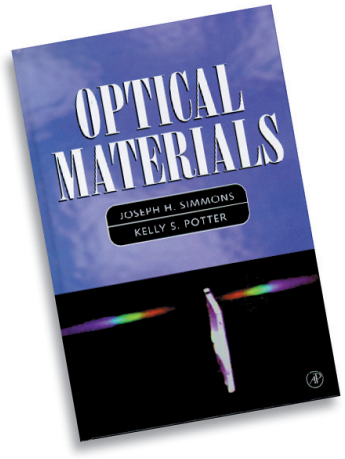
The author, John Vacca, has written 29 books in the areas of Internet security, programming, systems development, and multimedia. I am impressed with both the number of books he has written and the wide variety of areas he writes about.

I am sorry to say that while I am impressed with the author, I am not impressed with the book. *Holograms & Holography* aims to cover an enormous amount of material, but in doing so it does not cover any one topic in much detail. Also, not nearly enough references are given for the reader to find the detail he or she wants. It seems as though the book was written much too fast and that not enough care was taken in the writing. For example, twice the author states, "The second part of this book identifies intranet security trends over the Web: client and server, procedures and tools, and system and intranet administration currently in place within most organizations." What do these words have to do with this book? Can they be left over from a previous book?

Several of the pictures in the book have poor contrast and are not very sharp. I thought the printer had done a poor job, but the copies of the pictures on the CD are equally bad. I am not sure why complete Web sites were included on the CD. When I looked up the Web sites on the Internet I found many changes had been made since the Web sites were put on the CD. Also, some of the pictures for the Web sites on the CD appeared to be missing. In my opinion, the holograms were the best part of the book.

As I was completing this review, I decided to check Amazon.com to see if anyone had written a review of this book. I was amazed to find that while at the time this review is being written the book has been available only 2 1/2 months, there are already 12 reviews. (One of my favorite books on holography, *Optical Holography: Principles, Techniques, and Applications*, by Hariharan, was written five years ago and it has no reviews on Amazon.com.) Furthermore, all 12 reviewers give this book five stars. Can I be this far off? Further study shows me that many of John Vacca's books have several reviews on Amazon.com and almost all of them are five stars. Furthermore, while the books cover different topics, many of the same people review all of them. I guess he has some loyal readers, or at least some loyal reviewers. I am sorry I am not one of them.

James C. Wyant, professor of optical sciences and director, Optical Sciences Center, University of Arizona, Tucson, Arizona, e-mail jcwyant@optics.arizona.edu.



Optical Materials

Joseph H. Simmons and Kelly S. Potter
Academic Press, January 2000
ISBN 0126441405
391 pages, $83.95 (hardcover)

REVIEWED BY M. F. MAHMOOD

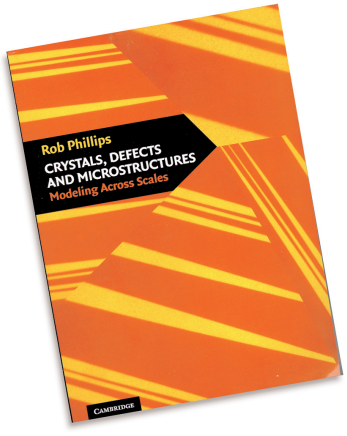
Optical Materials describes the underlying mechanisms that determine the optical behavior of metals, insulators, semiconductors, laser materials, and nonlinear materials. The book is intended to provide an in-depth treatment of atomic composition and chemical makeup, electronic states, and the band structure and physical microstructure of materials related to their optical behavior. Readers will find that it presents a worthwhile review of current principles and practice. It is a particularly valuable addition to the literature since it addresses the subject from both a theoretical and a practical modeling slant. The authors are certainly familiar with the subject: they have made important contributions to this expanding technology. They state that the aim of the book is to provide an overview for the novice as well as the expert.

The text is organized in seven chapters. After a brief introduction, the authors review in chapter 2 the optical properties of conductors. The optical properties of insulators are discussed in chapters 3 and 4, with a description of some insulating optical materials from an application point of view. Chapter 5 mainly deals with the optical properties of semiconductors, with an emphasis on theory. Chapter 6 reviews background material on lasers and lays the theoretical foundation for the develop-

ment of a theory on optical gain. Chapter 7 is devoted to nonlinear optical processes in materials; it also describes some of the principal concepts and mathematics of nonlinear optics.

The book will be particularly valuable to a graduate student or a material scientist just entering the field. It features a list of pertinent references of technical papers, as well as an index. I especially recommend it to newcomers to optical materials technology and to those with a peripheral interest in it.

M.F. Mahmood, senior research scientist, Department of Electrical Engineering, Howard University, Washington, D.C. E-mail: mmahmood@howard.edu.



Crystals, Defects and Microstructures

Rob Phillips
Cambridge University Press, March 2001
ISBN 0521793572
720 pages, $48.00 (paperback)

REVIEWED BY K. ALAN SHORE

One wonders whether the contribution of the materials scientist is always properly acknowledged: when products work to specification, it is often the basic invention that is praised, not the process which has translated the concept into reality.

An empty plinth in Trafalgar Square, London, has recently been occupied by a somewhat controversial sculpture formed in a transparent resin. *Monument* is the work of artist Rachel Whiteread, who has become famous for making works of art by forming casts of everyday objects. In 1993, she won the Turner Prize for a monolithic concrete cast of a house. *Monument* is actually a cast of the plinth on which it stands. Art critics and the public alike will, no doubt, debate the merits of *Monument* for some time to come. One issue which may not be at the forefront of the debate is the actual physical process by which the sculpture was created. It appears that the transfer of the artist's vision into a real object was a significant technical challenge: the resin had a tendency to crack, thereby severely detracting from the intended transparency.

Scientific creativity generates bright ideas for new products and devices. Transforming bright ideas into useful technology can, however, be a time-consuming and expensive activity. The challenges to technology transfer can be very technical in nature, with potential devices and products simply not living up to predicted performance. In other cases, the challenges may be more fundamental: it may be impossible to construct even a prototype.

Often, the fundamental barrier to implementation is the lack of suitable materials. Failure of prototypes to meet design specification can also sometimes be traced to materials issues. In all these cases, the professional whose contribution becomes critical is the materials scientist. *Crystals, Defects and Microstructures* was written by Rob Phillips in part so that he could learn more about the methods he uses as a materials scientist. It is very fortunate for the scientific community that he decided to share his learning process.

The scope of the book is wide and, indeed, this is quite a long book: almost 800 pages. However, the writing style makes reading most enjoyable. The interesting aspect of the style is the author's readiness to stand back from the details to communicate to the reader an important message. This often happens when he wants to move a discussion in a new direction or take a line of argument into greater detail. Before doing so, he will ask the reader to "recall from our previous discussion... " These punctuations in the flow of the text help ensure that earlier lessons have been learned before new material is offered.

There is much to digest in this book, which manages to carry the reader from basic quantum and statistical mechanics through to the details of material fracturing. What the author seeks to do is explain the techniques for modeling materials. His intention is to "reveal the habit of mind that can be brought to the study of materials." It should be made clear, however, that the book does come to grips with explicit mathematical methods, and hence can be used as a source for practical techniques to approaching real-world challenges in material modeling. What the reader is spared is a deluge of detail which could deflect from the central theme. A good bibliography directs the active reader to sources of further information. The author has also included some challenging problems to test the understanding of the material and develop it further.

Although the book is directed at material modeling, care is taken to relate the work to real-world situations and copious references are made to experimental results. The focus is, not unexpectedly, on physical science. The book itself raises the intriguing idea that the methods of materials science will find increasing use in the biological sciences.

Aimed at graduate students and researchers, *Crystals, Defects and Microstructures* will teach budding materials scientists the tricks of their intended trade. For this they will be extremely grateful to Rob Phillips. In turn, when they ply their trade to develop new technological products and help troubleshoot underperforming devices, their co-workers will, no doubt, appreciate their efforts. One wonders, however, whether the contribution of the materials scientist is always properly acknowledged: when products work to specification, it is often the basic invention that is praised, not the process which has translated the concept into reality. It is gratifying that in the artistic world such contributions are recognized, and it is to be hoped that scientists will, in this sense, follow the lead of Rachel Whiteread. Conversely, the makers of *Monument* could well profit from a perusal of chapter 11 of this book, which may give them insights into the formation of cracks in transparent resin sculptures.

K. Alan Shore is a professor in the School of Informatics at the University of Wales, Bangor, Wales, U.K. His e-mail address is alan@sees.bangor.ac.uk.

Molecules and Clusters in Intense Laser Fields

Jan Posthumus, Ed.
Cambridge University Press, 2001
ISBN 0521772400
272 pages, $80.00 (hardback)

REVIEWED BY HSIUNG HSU

This book presents an interesting introduction to advances in ultrafast and ultrashort pulse lasers and the effects of intense laser fields on molecules and clusters.

The advent of femtosecond laser sources has sparked efforts to analyze ultrafast chemical reactions and ultimately to control chemical reactions using lasers in real time. This research has also led to the application of very intense electric fields in clusters for the generation of high-order harmonic waves and coherent soft x rays. This book presents an interesting introduction to advances in ultrafast and ultrashort pulse lasers and the effects of intense laser fields on molecules and clusters.

Molecules and Clusters in Intense Laser Fields has seven chapters. Chapter 1 presents an overview of the advances in ultrashort pulsed laser technology through development of chirped-pulse amplification, including a complete description of the self-mode-locked Ti:sapphire laser system, together with pulse stretcher and compressor design.

Chapter 2 reviews the experimental and theoretical aspects of diatomic molecules in intense Ti:sapphire laser fields.

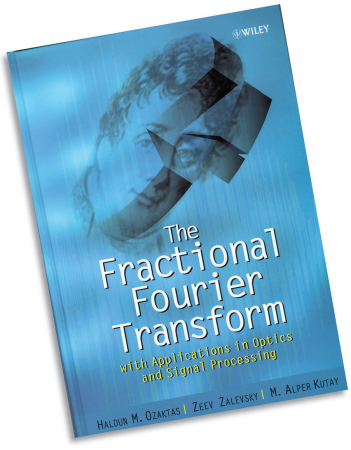
Chapter 3 starts with general considerations about laser excitation of small molecules, and continues with a discussion of the physics and experimental techniques associated with laser-induced multiple ionization.

The book explains how a simple experimental setup with statistical correlation techniques can resolve many aspects of the fragmentation dynamics of polyatomic molecules. Chapters 4 and 5 describe the control of interactions of clusters with intense laser fields using tailored short laser pulses to drive the evolution into a specific dissociation or ionization channel and obtain the desired product. Chapter 6 describes single-cluster explosions and high-harmonic generation leading to the production of coherent ultraviolet and soft x rays using cluster gases as the nonlinear medium (cluster plasma). Chapter 7 is concerned with laser interactions with extended cluster media. The list of references that follows each chapter is extensive. There is an index at the end of the book.

The book is well edited and covers up-to-date experimental and theoretical research in the area of intense laser fields. It is, in a sense, a progress report, in that it often presents varying views and interpretations. Indeed, as the author states in several places, many questions remain unanswered and will require further investigation.

The objective of *Molecules and Clusters in Intense Laser Fields* is to introduce graduate students and research scientists to ultrafast laser research. The book will also be of interest to researchers in nonlinear optics, material science and engineering, plasma physics, chemistry, and laser fusion. I also recommend it to medical and biomedical researchers for the potential applications of intense, ultrashort pulsed lasers to their areas of research.

Hsiung Hsu is with the Department of Electrical Engineering at Ohio State University. His e-mail is hsu@ee.eng.ohio-state.edu.



The Fractional Fourier Transform

With Applications in Optics and Signal Processing

Haldun M. Ozaktas, Zeev Zalevsky, and M. Alper Kutay
John Wiley & Sons, Ltd., 2001
ISBN 0471963461
513 pages, $105 (hardcover)

REVIEWED BY AXEL M. KOENIG

Over the past ten years, the fractional Fourier transform has generated considerable interest. The primary purpose of this book is to provide a widely accessible account of the transform, covering both theory and practice.

To read this book, an undergraduate background in signals and systems, as well as in linear algebra, is a must. The authors intended the book for graduate students, academics, and researchers in the mathematical and physical sciences as well as in engineering.

The research areas covered include topics such as operator theory, harmonic analysis, group representation theory, phase-space methods, time- and space-frequency representation, and integral transform theory and techniques. Signal processing/analysis and wave propagation, along with their application to the field of optics, are also discussed.

The material covered could be easily tailored to an advanced course in Fourier optics or to a course in information optics featuring phase-space concepts, Wigner distributions, and propagation issues in quadratic, graded-index media. For those interested primarily in optics, three chap-

ters (7, 8, and 9) offer extensive coverage. Wave-optical and geometrical-optical characterization of optical components are also considered. A chapter on phase-space optics includes quadratic-phase systems and linear-canonical transforms. Imaging systems and optical invariants are also discussed.

Chapter 9 deals exclusively with the fractional Fourier transform in optics. In this chapter, the authors give a detailed account of quadratic-phase systems such as fractional Fourier transform and propagation in quadratic, graded-index media. Diffraction phenomena, including Fresnel diffraction, are brought into context. The authors investigate multilens systems and Fourier optical systems. Hermite-Gaussian beam expansion is used to explore the Gouy phase shift, as well as spherical mirror resonators and their stability. A brief discussion of wave-field reconstruction and phase-space tomography can also be found in this chapter.

The core analytical and numerical treatment of the fractional Fourier transform is established in chapters 4-6. The analysis of signal content is provided in terms of time-order and space-order representation. Numerical implementation of the discrete Fourier transform is considered in a separate chapter. The abstract theoretical framework of linear canonical transforms, which includes wavelet transforms, Wigner distributions, and the fractional Fourier transform, are also discussed.

The final chapters (10, 11) include applications of the fractional Fourier transform to filtering, signal detection, and recovery, as well as to pattern recognition. Almost every chapter has a historical section with excellent references and suggestions for further reading. The authors have provided an extensive list of references. Supplementary tables and useful examples make this book a pleasure to read. The book also has a valuable bibliography on the fractional Fourier transform, which is separate from the bibliography of other cited works.

I highly recommend this book, with its wealth of resources and references. I would not be surprised if it becomes a standard reference text on the fractional Fourier transform.

Axel Mainzer Koenig, chief executive officer, 21st Century Data Analysis, Portland, Oregon, e-mail: DSPACE21@aol.com.

Understanding the Light Microscope

D. J. Goldstein
Academic Press, September 1999
ISBN 0122886607
192 pages, $73.95 (hardcover + CD-ROM)

REVIEWED BY BARRY R. MASTERS

Understanding the Light Microscope is a CD-ROM package containing four interactive computer programs and a textbook. The package provides an interactive format for exploring: ray optics; aberrations of thick lenses; polarized light; and diffraction and its effects on image formation.The book is aimed at medical students, undergraduate students in biology and biomedical engineering, and physicists in academia and industry.

What aspects of the light microscope are simulated by each computer program? The Zernike program can simulate Fraunhofer and Fresnel diffraction by slits and gratings. The user can work with the following types of imaging systems: bright-field; oblique illumination; phase contrast; Schlieren; modulation contrast; interference microscopy; fluorescence microscopy; and confocal microscopy. The effects of coherence, illumination, aperture, spherical aberration, and focus of the objective can be studied. The textbook includes several suggested exercises that can be performed with the Zernike program.

The purpose of the Kohler program (named after Köhler, but spelled differently) is to help teach phase-contrast microscopy as well as bright-field microscopy. This part of the package introduces the concepts of: real and virtual images; conjugate planes; field and aperture diaphragms; Köhler versus "critical" illumination; and the epi-illumination microscope. Quantitative aspects of polarized-light microscopy are the subjects of the Nicol program.

I recommend *Understanding the Light Microscope* to those who wish to increase their understanding of the optical principles of the light microscope.

Named for Willebrod Snel of Leiden, the ray-tracing program, Snellius, can be used to study the effects of aberrations on image formation with simple and compound lenses. Both chromatic and spherical aberrations are simulated, along with coma, astigmatism, curvature of field, and distortion.

D. J. Goldstein has written a concise, well-organized textbook which includes many interesting historical facts. The text is interspersed with numerous line drawings to help the reader understand key concepts. I found the sections on Abbe's diffraction theory and the extension of the Abbe theory to transparent objects very interesting because the latter clearly explains Zernike's phase-contrast principle.

The book includes classic citations: Abbe on the theory of the microscope (1873); Caspersson on cell structure (1936); Denk *et al.* on two-photon laser scanning fluorescence microscopy (1990); Hoffman on modulation-contrast microscopy (1977); Inoué on the polarizing microscope (1957); Kachar on asymmetric illumination contrast (1985); Köhler on light microscopy (1894); McCutchen on super-resolution in microscopy (1967); Naora on confocal microscopy (1951); Sparrow on resolving power (1916); Toraldo di Francia on resolving power (1955); and Zernike on phase-contrast methods (1934).

Do the computer programs aid the user in understanding the light microscope? The answer is yes! I recommend *Understanding the Light Microscope* to those who wish to increase their understanding of the optical principles of the light microscope and have fun in the process.

Barry R. Masters, a Fellow of OSA and SPIE, is a consultant in Arlington, Virginia. He can be reached at brmail2001@yahoo.com.