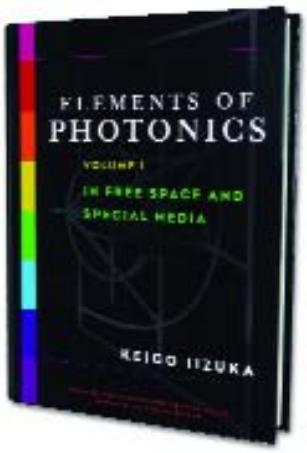

Elements of Photonics Volume I

Keigo Iizuka
John Wiley & Sons, 2002
ISBN 0471839388
1056 pages, $200 (hardcover)

REVIEWED BY JINGYI WANG

Elements of Photonics treats the complementary topics of fiber optics and integrated optics in a comprehensive and thoughtful manner that makes this two volume set particularly well suited for use as a textbook or as a self-study guide.

Volume I, which consists of eight chapters, covers topics in the area of propagation in free space and in special media such as anisotropic crystals. In particular, a broad range of information is presented on: Fourier optics; boundaries and near-field optics and imaging; Fabry-Perot resonators, beams and radiation pressure; the propagation of light in anisotropic crystals; the optical properties of crystals under various external fields; the polarization of light; how to construct and use the Poincaré sphere; and phase conjugate optics. Volume II provides an excellent discussion of the electromagnetics of light in bounded media, such as fibers.

Both volumes include numerous problems and solutions. The careful, detailed and thorough coverage given each of the topics makes *Elements of Photonics* extremely well suited for use by students, either as part of an organized course or in a seminar or self-study setting. The book is well organized, with a helpful appendix, extensive references and an index. Iizuka, a recognized authority in the field of optics education, has provided us with a photonics textbook that has everything needed to meet the needs of students and photonics engineers. The volumes, which blend fundamentals with applications, are appropriate for a fourth-year undergraduate or first-year graduate course, or as a resource for engineers.

In particular, the author does an excellent job of explaining optical propagation in free space and special media in a detailed and thorough yet straightforward and succinct way. This set was definitely written with the student in mind.

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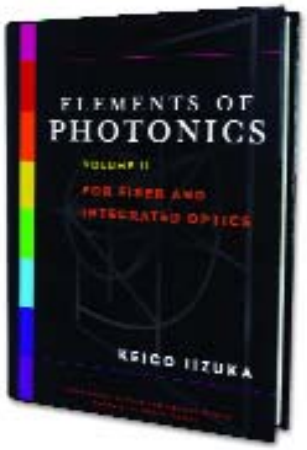


Elements of Photonics Volume II

REVIEWED BY FARHAN RANA

Volume II of Keigo Iizuka's *Elements of Photonics* covers integrated optics, fiber optics, lasers and optical communication systems. The book contains numerous problems and worked-out solutions and is intended for use as a textbook at the advanced undergraduate or beginning graduate levels. The material in the book is well presented and several key concepts are discussed in detail.

The author has made efforts throughout to present simple descriptions of many complex and difficult topics. But a poor choice of topics and some conceptual errors mean that the book is not ideal for use as a textbook. Some examples are given here to elucidate the point. The sections on integrated waveguides and optics barely touch on the coupled mode equations for optical couplers and distributed Bragg reflectors. Integrated optical filters, resonators, channel add/drop devices, optical multiplexers and demultiplexers and other integrated optical components are hardly discussed, if at all. On the other hand, almost 30 pages of Chapter 15 are devoted to nonlinear integrated optical waveguides which, to the best of the reviewer's knowledge, have not found any practical application since materials with suitably large Kerr nonlinearity remain to be discovered. The expression for the optical gain in semiconductor lasers derived in Chapter 14 is incorrect. The (approximate) conservation of crystal momentum has been completely ignored.[1] In Section 16.5, which discusses the noise mechanisms in photodetectors, the reader is told, "the flow of electrons across the pn junction is like pouring a bucket of beans into another bucket. Each bean arrives discreetly and randomly. Each discrete electron is equivalent to a delta function of current whose Fourier transform has a constant spectrum in the frequency domain, giving a white noise characteristic." The author presents this as an explanation for the shot noise observed in pn junction photodetectors. This is again wrong. Electron flow across pn junctions is regulated by Coulomb correlations and the noise generated in transport across pn junctions is negligible. The actual source of noise in pn junction photodetectors is the incident photon stream itself. For example, the noise in a photon stream can be suppressed below the shot noise level if the light is prepared in a quantum mechanical squeezed state. When squeezed light is incident upon a photodetector, the output current also has noise much below the shot noise level. The commonly observed shot noise in pn junction photodetectors is caused by the

fact that classical light is well approximated by a quantum mechanical coherent state which also has shot noise characteristics.[2] Several such errors can be found elsewhere. In Section 14.8, which discusses noise mechanisms in semiconductor lasers, the noise contributions from stimulated emission and photon loss from the cavity are left out of the discussion. Above threshold, these processes are the most important sources of the intensity noise in lasers.[3]

As long as the reader is willing to ignore the shortcomings, he/she will find a large amount of material related to many different areas of fiber and integrated optics. The book will be a helpful reference for engineers and researchers whose main focus is not optics. However, scientists engaged in optics may find it less inspiring.

Farhan Rana (farhan@mit.edu), MIT, Cambridge, Mass.

References

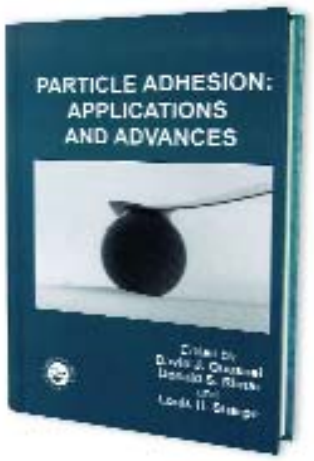
1. S. L. Chuang, *Physics of Optoelectronic Devices*, Wiley, N.Y. (1995).
2. H. A. Haus, *Electromagnetic Noise and Quantum Optical Measurements*, Springer, N.Y. (2000).
3. L. Coldren, S. Corzine, *Diode Lasers and Photonic Integrated Circuits*, Wiley, N.Y. (1995).

VISA Advice

The International Visitors Office (IVO) of the National Academies has a new Web site (www.nationalacademies.org/visas) that provides visa information to visiting scientists and scholars, and advice for organizers of scientific meetings in the U.S. The site includes a questionnaire scientists can use to report difficulties they are having with the visa process. The questionnaire is used by the IVO to collect statistics and, in some cases, to assist with the visa process. The IVO maintains a list of international scientific meetings held in the U.S. It shares the list with the Department of State to help validate a visa applicant's purpose for visiting the U.S.

To register a meeting, organizers should send the IVO (visas@nas.edu) the following details: meeting name, location, date and Web site link. The IVO site also has guidelines for organizing international scientific meetings in the U.S.

You are encouraged to add a link to the IVO site on your Web site. If you have any comments on how the IVO site can better inform and assist you and your colleagues on visa issues, please send your comments to visas@nas.edu



Particle Adhesion: Applications and Advances

David J. Quesnel, Donald S. Rimai and Louis H. Sharpe, Eds.
Taylor and Francis, 2001
ISBN 90569972504
504 pages, $80 (hardcover)

REVIEWED BY CHRISTIAN BROSSEAU

Analysis of the behavior of particles on solid surfaces constitutes a rapidly developing area of materials science which is important to a number of technologies, including catalysis, nanotechnology and optoelectronics. There remains, however, a lack of understanding of the surface physics. In most cases, particles are not thermodynamically stable on surfaces and would undergo smoothing reactions, such as wetting and burrowing, were it not for kinetic constraints. This book is therefore very timely. The authors and editors have done a great service to the materials science community.

The book's objective is to show researchers and engineers with little or no background in the field how to use the basic concepts of particle adhesion in their own disciplines. A good materials science background is necessary to derive the most benefit from the text, which targets a wide audience and covers a range of subjects. Each of the 21 chapters is written by a group of well-known experts in the field, most from the U.S. An attempt has been made throughout to include the most recent references.

The first section provides the background for understanding the biological applications of particle adhesion. In the second section, the role of viscoelasticity in particle adhesion is discussed. In the third section, recent research on particle surface interactions that influence adhesion is summarized. Much of the material in this section could serve as a starting point for further research on nanometer-scale adhesion. In the fourth section, electrical conductivity through particles is discussed. Next, the authors describe the use of scanning electron microscopy and atomic force microscopy (AFM) to measure adhesion. I was especially pleased to see a clear exposition of adhesive interactions measurement with AFM. The final chapters are devoted to recent advances in controlling the attachment and removal of groups of particles.

It is incumbent on reviewers to say what they did not like about a book, but in this case that is a tough assignment. In several instances, such as the discussion of scanning force microscopy, I feel that some comment on the limitations of the technique would have offered a more balanced view.

This easy-to-read book retains a fresh perspective on a subject that has undergone substantial development over the last decade, and my knowledge of particle adhesion was significantly enhanced by reading it. Each chapter includes a section of bibliographic notes, which I found interesting and helpful. Although this is not a book that one reads from beginning to end, the extensive figures and examples make it suitable as a self-study guide.

In summary, this an extremely well done book that offers a balanced view of a variety of techniques. It would be a useful reference for researchers and for any student interested in particle adhesion. The book will be of value to those interested in materials science, biology, xerophotography and optoelectronics, among other fields.

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