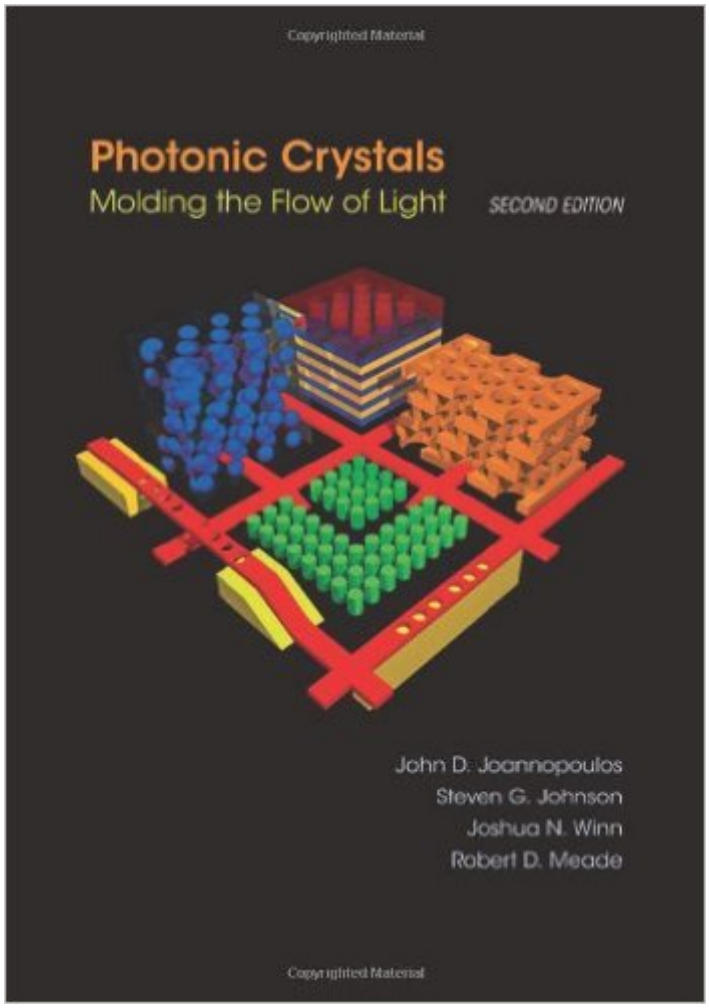
Photonic Crystals: Molding The Flow Of Light, Second Edition



Synopsis

Since it was first published in 1995, Photonic Crystals has remained the definitive text for both undergraduates and researchers on photonic band-gap materials and their use in controlling the propagation of light. This newly expanded and revised edition covers the latest developments in the field, providing the most up-to-date, concise, and comprehensive book available on these novel materials and their applications. Starting from Maxwell's equations and Fourier analysis, the authors develop the theoretical tools of photonics using principles of linear algebra and symmetry, emphasizing analogies with traditional solid-state physics and quantum theory. They then investigate the unique phenomena that take place within photonic crystals at defect sites and surfaces, from one to three dimensions. This new edition includes entirely new chapters describing important hybrid structures that use band gaps or periodicity only in some directions: periodic waveguides, photonic-crystal slabs, and photonic-crystal fibers. The authors demonstrate how the capabilities of photonic crystals to localize light can be put to work in devices such as filters and splitters. A new appendix provides an overview of computational methods for electromagnetism. Existing chapters have been considerably updated and expanded to include many new three-dimensional photonic crystals, an extensive tutorial on device design using temporal coupled-mode theory, discussions of diffraction and refraction at crystal interfaces, and more. Richly illustrated and accessibly written, Photonic Crystals is an indispensable resource for students and researchers. Extensively revised and expanded Features improved graphics throughout Includes new chapters on photonic-crystal fibers and combined index-and band-gap-guiding Provides an introduction to coupled-mode theory as a powerful tool for device design Covers many new topics, including omnidirectional reflection, anomalous refraction and diffraction, computational photonics, and much more.

Book Information

Hardcover: 304 pages
Publisher: Princeton University Press; Second edition (March 2, 2008)
Language: English
ISBN-10: 0691124566
ISBN-13: 978-0691124568
Product Dimensions: 7.2 x 1 x 10.3 inches
Shipping Weight: 2.4 pounds (View shipping rates and policies)
Average Customer Review: 4.5 out of 5 starsÂ Â See all reviewsÂ (15 customer reviews)

Best Sellers Rank: #989,538 in Books (See Top 100 in Books) #66 inÂ Books > Engineering & Transportation > Engineering > Electrical & Electronics > Electronics > Optoelectronics #71 inÂ Books > Science & Math > Chemistry > Crystallography #150 inÂ Books > Science & Math > Physics > Light

Customer Reviews

As a co-author of the new edition, I'm obviously a bit biased, but I think this book occupies a unique position in this field as a broad advanced-undergraduate/beginning-graduate introduction to photonic crystals and light in periodic media, focusing on timeless fundamentals and richly illustrated with examples of many different structures. Compared to the first edition, it is greatly expanded and improved, with almost every chapter seeing significant revisions and several entirely new chapters; the second edition is roughly double the length of the first.However, the main reason I am posting here is that you don't need to take my word for it; the publishers have allowed us to post a PDF of the entire book online for no cost, so you can determine whether it is useful to you before purchasing the paper version (beautifully printed in full color). See ab-initio.mit.edu/book (where you can also find errata etcetera).Compared to classic textbooks like Hecht or Jackson, this book occupies a somewhat different ground. It is not concerned with geometric optics (where the wavelength is small compared to the structure) or with the handful of geometries that can be solved almost completely analytically (vacuum, planes, cylinders, and spheres). Rather, it deals with the vast array of problems in nanophotonics where the wavelength is comparable to the structure, and especially with periodic (or partially periodic) "crystalline" structures. In these cases, although completely analytical solutions are usually impossible, the book explains how there are more general principles such as symmetry and linear algebra that reveal the fundamental structure and behavior of light in such media.

Keeping in mind, I started my research in photonic crystals with my advisor referring me to this book. So, I am speaking as a first-year graduate student with basic physics background. Hopefully, you come in this category of inexperience looking for some advice on approaching a difficult subject to understand. My only suggestion is to ask around your research group for other reading materials and also get to know your library well. In any case, you can also check out my profile which has a listing of optics and photonic crystal books that can help you out as well. So, I just wanted to let you know where I am coming from since other reviewers might be educators who already have a good understanding of photonic crystals. In some ways, it pretty much assumes alot of knowledge like my

advisor who assumed me to be much the same which I was not.In this fairly thin book, Joannopoulos basically rehashes the concepts of photonic crystals from his review papers in journals. Although this book may be appropriate who have read his articles, it probably is not the best source for undergrad/grad students who want to really get the details. The book has some illustrations which may or may not get the point across to readers. For beginners, I would suggest going to "Scientific American" article which Joannopoulos writes to a general audience with little or no background in optics. This gives a wonderful explanation about total internal reflection and how it relates to fiber optics. Then, it ties into the idea of crystals trapping light. Afterwards, you can consult with an undergrad optics book (Hecht or Pedrotti) which will go into basic optics. The price of this book is also quite expensive for just a short overview.