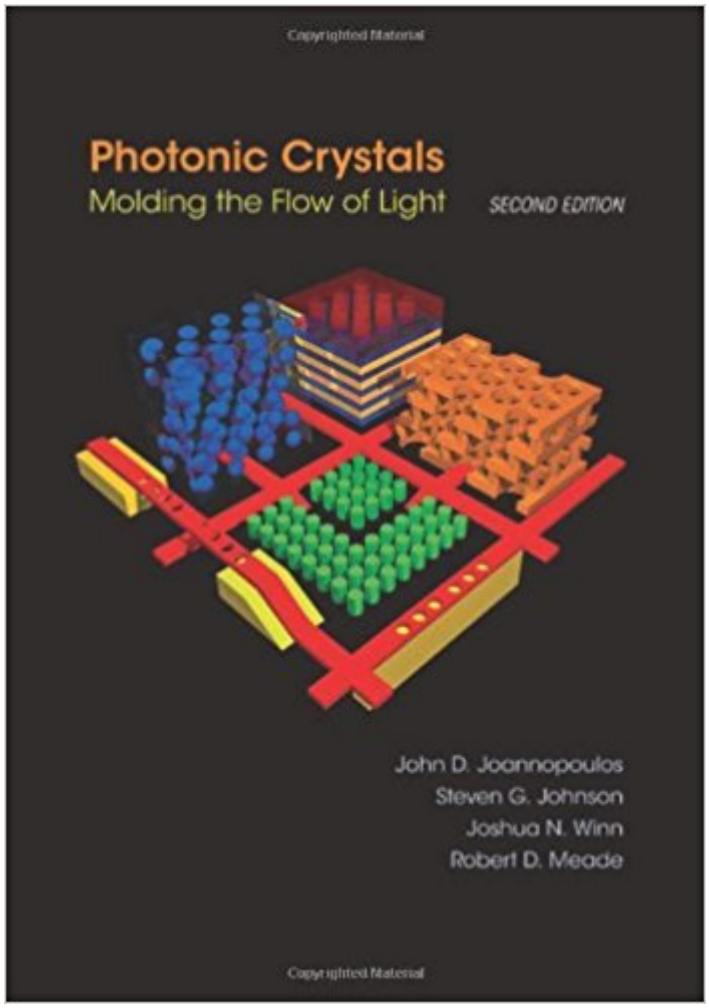
Photonic Crystals: Molding The Flow Of Light, Second Edition



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

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Customer Reviews

"Photonic Crystals is a timely and well-written account of this new field."--Nature"This book offers elegant full-color illustrations and is superbly produced. This has to be applauded in an era dominated by low-resolution digital images. In summary: Photonics Crystals is a beauty and is highly recommended to photonics, laser, and optical scientist."--Optics Journal"This text is certainly pitched at a post third-year quantum mechanics, electromagnetism and solid-state physics level in the Australian context and is ideally suited to study at an Honours or a Masters level. [Images freely available from MIT complement this text]. Certainly for all who offer photonics courses, this book should be in your institution’s library if not on your shelf."--John Holdsworth, Australian Physics

"This book is destined to become the classic textbook in the area. It gathers together the fundamental concepts and tools relevant to photonic crystals and presents them with exceptional clarity. I genuinely enjoyed reading it."--Maryanne Large, University of Sydney"An excellent textbook to be used in physics, chemistry, and engineering. The revised edition of Photonic Crystals fills the gap between the layperson and the expert reader."--Costas M. Soukoulis, Iowa State University

This visually attractive book is also very informative, particularly for someone with a background in solid-state physics and eletromagnetism. The reformulation of Maxwell’s equations as a Hamiltonian theory was a very interesting insight for someone (me, OK?) with a traditional physics graduate school education. Another interesting insight is that scalar diffraction theory works when polarization effects are unimportant, and polarization effects are unimportant when the periodicity is large compared to the wavelength of light. A third is the development of the eigenvalue as the mode-weighted average over the bulk indices of refraction of the materials composing the structure.The mathematical development is just perfect to get the main ideas across without burying the reader. There are entrees into the literature for more advanced developments.

The authors give great physical explanations with just the right amount of mathematical rigor. The analogy with quantum mechanics is made continuously through the text which helps with intuition.

This book is definitely going to be a classic.

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. The book uses these principles to explain the most important optical properties of these structures, from confinement of light in 3d band gaps to periodic dielectric waveguides and optical fibers. It also introduces the powerful tool of temporal coupled-mode theory to design devices by coupling waveguides and microcavities.

Great easy to read, conceptually covers relevant main and background material, very colorful supporting pictures and plots, written by experts in this field.

First, a disclaimer: I am a graduate student working within the research group of two of the authors (JDJ & SGJ). I used the first edition of this book (as did many other researchers) extensively when being first introduced to this field and have been able to compare it with this most recent edition given my familiarity with both editions. The 2nd edition is a significant improvement over the 1st edition, for many reasons: 1) the content is further polished and well presented (owing in part to the emphasis on clarity in communication placed within our group), 2) the figures, equations, and fonts

are much more readable than before and 3) there are at least three new chapters that provide timely information on emerging subfields (periodic dielectric waveguides, photonic crystal slabs and photonic crystal fibers). An extensive (and expanded) bibliography and appendix (with an extra section on computational photonics) supplement the main text well. The book is at least twice as thick as the 1st edition with new and updated content and is exquisitely bound & illustrated. Indeed, it is true that a free copy of this book has been posted on the authors' website, but owning a hard copy is a valuable reference as well. The 2nd edition is not simply a superficial revision of the 1st, it is a much needed improvement for a field that has seen a tremendous amount of growth in the intervening years of the books' first publication.

As a first year graduate student, this is the first book I read about photonic crystals. The author made a lot of comparison between Electrodynamics and Quantum Mechanics, and between photonics crystals and solid state physics. (I like it because I have some solid state physics background.) The math in this book is rigorous and beautiful, but is never abused. Most of the content give us intuition about what is happening in photonic crystals, instead of just formulas. Actually there are too few formulas in this book...This is the Second Edition. It talks a lot more about realistic 3D structures like Photonics-Crystal Slabs. You cannot find them in the First Edition.Generally speaking I love this book. It is a great introduction to the area.

Fancy printout, great structure, and great content. But, as an engineer, I found the first three chapters -(basing for further ones)- difficult with unfriendly jargon, which requires good background in quantum mechanics & its mathematics. Besides, the book: lacks numerical examples, lacks practical & simulation examples, almost purely theoretical approach, and hard terminology (at least for engineers). I may recommend this book, for those who have prior knowledge/experience in this field with being keen on physics & math of the subject.

Proteins and Nanoparticles Crystals: Crystal Healing For Beginners, Discover The Healing Power Of Crystals And Healing Stones To Heal The Human Energy Field, Relieve Stress and Experience Instant Relaxation !-THIRD EDITION- Nano-Optics for Enhancing Light-Matter Interactions on a Molecular Scale: Plasmonics, Photonic Materials and Sub-Wavelength Resolution (NATO Science ... Security Series B: Physics and Biophysics) Crystals and Stones: A Complete Guide to Their Healing Properties (The Group of 5 Crystals Series) 101 Power Crystals: The Ultimate Guide to Magical Crystals, Gems, and Stones for Healing and Transformation Crystal Healing: Charge Up Your Mind, Body And Soul - Beginner's Journey (Crystal Healing For Beginners, Chakras, Meditating With Crystals, Healing Stones, Crystal Magic, Power of Crystals Book 1) Crystals for Energy Healing: A Practical Sourcebook of 100 Crystals The Essential Guide to Crystals: All the Crystals You Will Ever Need for Health, Healing, and Happiness (Essential Guides Series) Crystals for Beginners: A Guide to Collecting & Using Stones & Crystals (For Beginners (Llewellyn's)) Crystal Healing: Charge Up Your Mind, Body And Soul - Beginner's Journey (Crystal Healing For Beginners, Chakras, Meditating With Crystals, Healing Stones, Crystal Magic, Power of Crystals) (Volume 1) X-Ray Diffraction: In Crystals, Imperfect Crystals, and Amorphous Bodies (Dover Books on Physics) Structural Dynamics of Electronic and Photonic Systems Physics of Photonic Devices Photonic Interconnects for Computing Systems: Understanding and Pushing Design Challenges (River Publishers Series in Optics and Photonics) Selective Photonic Disinfection: A Ray of Hope in the War Against Pathogens