DEPARTMENTS

BOOK REVIEWS

Optical Computing, An Introduction

Mohammad A. Karim and Abdul A. S. Awwal, 360 pages, illus., index, references. ISBN 0-471-52886-2. John Wiley & Sons, 605 Third Avenue, New York 10158 (1992) $59.95 hardbound.

Review by Mohamad A Habli, University of New Orleans, Electrical Engineering Department, New Orleans, LA 70148.

Optical computing has become the focus of intense attention in recent years. This attention is due to the need for faster parallel processing that can keep up with the complexity of new technology. Optical processors have been proposed to perform many tasks, for example, finding Fourier transforms of functions, performing convolutions, and solving systems of linear equations. However, optical processors are now needed to perform accurate computations. An introductory book on optical computing is essential for both researchers and students. This optical computing book by Karim and Awwal is a very valuable contribution.

The book has four main sections. The first section consists of Chaps. 1 and 2 and includes some mathematical preliminaries for optical computing. Chapter 1 reviews the Fourier transform, its properties, and its applications. The discrete Fourier transform (DFT) is also discussed in Chap. 1, and some computer programs that calculate the DFT are listed. This chapter then addresses diffraction theory using Green's function and Huygens's principle and relates diffraction theory to the Fourier transform. Finally, the Fourier transform property of a lens is addressed. Chapter 2 reviews digital image processing including image sampling/quantization, enhancement, and restoration. Both Chaps. 1 and 2 provide a solid background for optical image processing, which is essential for optical computing.

The second section consists of Chaps. 3 through 5 and addresses analog optical computing. Chapter 3 discusses a number of analog optical processors such as photographic film, spatial filtering using binary filters, holography, inverse filtering, and deblurring. Chapter 4 includes arithmetic operations and additional analog optical processing, such as halftone and nonlinear optical processing. Chapter 5 addresses recognition using analog optical processing. In this section, little is mentioned about analog optical devices; however, Chap. 10 addresses optical devices in more detail. Chapter 10 is in the last section of the book, which concerns digital optical computing. In my opinion, optical devices should have been addressed right after the first section and should not have been included in the analog or digital sections.

The third section consists of Chaps. 6 through 9, which address in detail digital logic topics such as Boolean algebra, arithmetic operations, logic gates, *K*-maps, flip-flops, registers, adders, and decoders. A review of digital logic is essential in an optical computing book. However, I think that this section could have been made more compact to leave room for optical material (rather than digital, which can be easily found in many books); one or two chapters is more than enough for a discussion of digital logic.

The last section consists of Chaps. 10 through 13 and addresses digital optical logic. Chapter 10, as mentioned before, discusses optical devices, Chap. 11 addresses shadow casting and symbolic substitutions, and Chap. 12 discusses optical matrix processing including multiplication, convolution, and programmable logic arrays. Finally, Chap. 13 discusses artificial intelligence computing systems, such as optical neural networks. It also discusses associative memory and its optical implementation and addresses optical interconnections. I think that the authors should have had separate chapters for optical memory and optical interconnections.

My overall view is that this book is an important contribution to the field of optical computing. It can be used as an introductory text in this field, and I intend to use it myself for a graduate course in optical computing.

Contemporary Nonlinear Optics

Edited by Govind P. Agrawal and Robert W. Boyd, 478 pages, illus., index, references following each chapter. ISBN 0-12-045135-2. Academic Press, 1250 Sixth Avenue, San Diego, CA 92101 (1992) $79.95 hardbound.

Reviewed by F. Kenneth Hopkins, Wright Laboratory, Materials Directorate, Wright-Patterson AFB, OH 45433.

Nonlinear optics often appears to be a mishmash of unrelated subjects and disciplines. It is concerned with electric polarization effects at the atomic level, the subsequent macroscopic field equations, the resulting physical phenomena, and the application of the phenomena. As a consequence, everyone—chemist, physicist, or engineer—is frustrated with a lack of understanding of some facet of nonlinear optics. Yet researchers must sufficiently understand the broader subject to effectively team with researchers in related fields. *Contemporary Nonlinear Optics* is a valuable resource for this purpose.

The editors of the book are successful in meeting their objective, "to provide a flavor of the current activities in the field of nonlinear optics." In doing so, they omitted a number of topics, such as nonlinear fiber optics, due to the seemingly unlimited breadth of the field. Therefore, the book does not provide a comprehensive overview, but this limitation does not severely lessen the book's usefulness. The many subjects that are addressed are discussed in an overview fashion, with valuable and extensive reference lists. The topics addressed are nonlinear guided-wave optics, optical solitons, optical phase conjugation (phenomena and applications), ultrafast nonlinear optics, quantum statistics in nonlinear optics (i.e., propagation phenomena: stimulated Raman scattering and squeezed light generation), photorefractive adaptive neural networks, nonlinear optical effects in organic materials, nonlinear optics in quantum confined structures, nonlinear laser spectroscopy, and optical bistability. The list of contributing authors is essentially a Who's Who in the field of nonlinear optics and includes Cristo Flytzanis, Paras Prasad, Demetri Psaltis, and George Stegeman.

In summary, *Contemporary Nonlinear Optics* is a recommended reference book that carries on the excellent tradition of Academic's quantum electronics series.