principle and is therefore applicable to a wide range of systems.

The book is essentially self-contained for a reader with some basic knowledge of bifurcation theory and higher analysis. The less prepared user will find a well-chosen sequence of elementary but significant examples and a good guide to the literature.

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Polarized Light in Optics and Spectroscopy

David S. Kliger, James W. Lewis and Cora E. Randall
Academic, San Diego, Calif., 1990. 304 pp. $64.50 hc ISBN 0-12-414975-8

The polarization of light is of considerable interest and has broad applications in virtually every branch of science and technology. Therefore the appearance of a new book in this field is welcome. The authors of this book are chemists of good standing, although they are relatively unknown to the optics community. A principal reason for writing this book, according to the preface, is that *Polarized Light* by William Shurcliff (Harvard U. P., Cambridge, Mass., 1962) is out of print and hence is not easily accessible. This argument is weak at best. Shurcliff's book, which remains the most lucid general exposition on polarized light, is readily available in many university libraries (for example, I was able to find copies at both Tulane and the University of New Orleans) and a student edition of the same book, which Shurcliff coauthored with Stanley Ballard, was published by Van Nostrand in 1964.

Several other books on polarized light have also appeared in recent years, including *Polarized Light and Optical Measurement*, by D. Clarke and J. P. Grainger (Pergamon, New York, 1971), *Ellipsometry and Polarized Light*, by R. M. A. Azzam and N. M. Bashara (North-Holland, New York, 1977) and *Matrix Theory of Photoelasticity*, by P. S. Theocaris and E. E. Gdoutos (Springer-Verlag, New York, 1979). This book does not mention any of these prior works or the numerous edited volumes and conference proceedings that have been published on polarized light, ellipsometry and polarimetry; nor does it refer to the valuable book-length (217-page) review "Crystal Optics" by G. N. Ramachandran and S. Ramaseshan in volume XXV of *Handbuch der Physik* (Springer-Verlag, Berlin, 1961). The absence of a credible bibliography diminishes this book's value as a reference.

As its title indicates, this book consists of two parts. The first part, "Polarized Light in Optics," chapters 1–5, contains less than one would expect under such a general heading. It is concerned mainly with three mathematical tools for the description of polarized light, namely the Jones calculus, the Mueller calculus and the Poincaré sphere. This section also includes some elementary pictorial representations of polarized light and brief descriptions of some of the basic devices that control polarization. There is little that can be considered new here, and similar material is readily available elsewhere. It does not discuss such current topics as polarization aberrations in optical systems, polarization optics of liquid crystals and fiberguides, magneto-optical recording and readout, optical isolators, and Q switches. Methods for measuring the state of polarization of light are also not to be found in this book.

The second part, "Polarized Light in Spectroscopy," chapters 6–8, is likewise too brief and narrow to serve as a general reference in this area. It mainly covers spectroscopy of aligned or partially aligned molecules in suitable hosts, a topic covered much more comprehensively in the book *Spectroscopy with Polarized Light* by J. Michl and E. W. Thulstrup (VCH, New York, 1986). The second part has better references than the first, but they are still few—fewer, for example, than in the authoritative review "Optical Spectroscopy of Oriented Molecules" by John Schellman and Hans Jensen (Chemical Reviews **87**, 1359, 1987).

An evident shortcoming of this book is that its two parts are disconnected. In particular, the tools developed in the first part are not at all demonstrated in the second. The reader will not see a Jones matrix, a Mueller matrix or the Poincaré sphere at work in chapters 6–8. Even the term "degree of polarization" has different definitions in the two parts of the book. Many topics in spectroscopy that would have fit nicely in the second part are omitted. I mention two examples: determination of vector magnetic fields in the solar atmosphere from the measured wavelength variation of the four Stokes parameters across a spectral line and the use of spectroscopic ellipsometry for the characterization of surfaces and thin films. (The importance of spectroscopic ellipsometry was underscored when David Aspnes received the 1987 Wood Prize of the Optical Society of America.)

The writing is not uniformly clear. Some passages will confound the student. For example, on page 11 it is stated that to calculate the intensity of light in terms of the field amplitudes in a sinusoidal plane-wave field requires "integrating over space, and taking the limit as time goes to infinity." In connection with phase retardation as light travels an isotropic medium or vacuum, one reads on page 40 to "remember that retarded refers to velocity, and since frequency is constant a larger number of oscillations (and hence more phase angle) are required to traverse the same space." In discussing phase shifts associated with total internal reflection, the authors state on page 246: "The storage of energy corresponds reasonably to a phase shift, since phase shift necessarily is introduced when the evanescent wave is formed."

On page 243 the discussion of external-reflection phase shifts at a dielectric surface is also confusing. For light reflection at a metal surface, the authors confuse, on page 248, the pseudo-Brewster angle with the principal angle and claim that the principal azimuth "is not unambiguously defined." The quarter-wave retardation is indicated as $\pi/4$.

Despite its limitations, this book provides another useful source from which to learn some of the standard tools for solving problems in polarization optics and some fundamentals of polarized light spectroscopy and its applications, mainly in chemistry.

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Optical Computer Architectures: The Application of Optical Concepts to Next Generation Computers

Alistair McAulay
Wiley, New York, 1991. 531 pp. $49.95 hc ISBN 0-471-63242-2

This is a comprehensive text authored by a prominent contributor to the field of optical computing. It is written in the style of Dror Feitelson's *Optical Computing* (MIT P., Cambridge, Mass., 1988) but McAulay's book is deeper in a number of areas and is oriented more toward the electrical engineer than the computer scientist. The book is divided into three parts: background for optical computing; subsystems for optical computing; and architectural models of computation. The 18 chapters are divided roughly evenly among the three parts, and an appendix is included on the derivation of the conjugate-gradient method. The author provides an excellent reference list that covers the breadth of the field, although it is somewhat odd that no reference is made to Feitelson's book.

The target audience appears to be those with backgrounds in electrical engineering. The optics introduction is too topical for computer scientists, and the digital logic introduction is too topical for physicists, but the introductions are just right for electrical engineers.

Part I starts out with a brief discussion of the needs of future computers and why electronics technologies will have difficulties meeting those needs. The advantages of optics in computing include greater speed, because there are no capacitive loads to charge, and improved cooling, because fast communication allows for greater device spacing. The book's introduction to optics is well tailored for optical computing, although the reader should have some background in optics, at least at the college physics level.

Topics include wave phenomena, interactions with media (reflection, refraction and diffraction), polarization, lens systems and Fourier optics. The author discusses the use of holograms for storing data and connections as well as spatial light modulators and their characteristics. McAulay includes an up-to-date table that compares characteristics and discusses digital versus analog computing as it relates to optical computing. Devices other than spatial light modulators, such as deformable mirrors and acoustooptic devices, are also discussed. In general, part I provides good, qualitative descriptions of some leading devices. Each topic in part I is covered in enough depth to gain an understanding of its relevance to optical computing and offers a good introduction for those working in the field who are unfamiliar with some areas.

Part II focuses primarily on optical subsystems for computing logic functions by means of global and local interconnects. Part II begins with optical interconnections based on crossbar switches, $\log_2 N$ interconnections and multistage interconnection networks. The author introduces the concept of memory in the form of random access, associative, cache and virtual memories. Holographic memory and the construction of holograms are discussed. There is a good discussion of computer arithmetic as it is done in real computers, including number representations and techniques for optical computer arithmetic, with an emphasis on addition.