imaging problem, the effects of finite apertures and the coherence of the illuminating source, but only a limited survey of common optical instruments. These are not serious shortcomings and could be remedied in a future edition, if the authors are so inclined.

The chapter on coherence devotes a fair number of pages to spatial and temporal coherence, light fluctuations and photon statistics, which I consider important and, indeed, essential entries in a modern textbook. It falls short, however, with the description of the laser as a source of coherent light. There is a definite inconsistency in stressing, on the one hand, the coherence of laser light and in explaining, on the other, the physical operation of this device in terms of spontaneous and stimulated emission processes. There is no easy way, in my opinion, for an inquisitive student to understand from this section the ultimate (and simple) reason why laser light is not just a highly monochromatic version of a thermal source.

An unusual and possibly questionable aspect of this book is that geometrical optics and the study of aberrations are relegated to two sketchy appendices and a few isolated comments and figures (see, for example, Chapter 9, concerned with image formation through optical instruments). While this is not inconsistent with the approach the authors state in the preface, potential users of this book will do well to keep this limitation in mind, especially since most students approach their first intermediate optics course with only a rudimentary knowledge of geometrical optics.

The appendix on Fourier transform computations is an excellent idea that should encourage the use of the many readily accessible minicomputers for numerical studies. Perhaps a future edition of this book may take advantage of this welcome break with tradition and require students to become more actively and systematically engaged in numerical work.

My general impression is that this book will find only limited use as the sole textbook in a traditional course because of the background knowledge of some conventional topics that it requires of students. In a typical curriculum, in which intermediate optics is the only course on this subject that physics and engineering students may elect to take, this book may play a useful role as a side reference. For other institutions, where optics represents a major program, these comments may not be appropriate. Thus, while not enthusiastic about the approach and selection of topics, I do not find myself with serious reservations. *Optical Physics* may offer teachers of optics some useful and broad-ranged supplementary information for their courses.

LORENZO M. NARDUCCI
Drexel University

Optical Fiber Transmission Systems

D. Personick
179 pp. Plenum, New York, 1981. $25.00

Optical Fiber Systems and Their Components: An Introduction

A. B. Sharma, S. J. Halme, M. M. Butusov
246 pp. Springer, New York, 1981. $38.35

Optical Fiber Technology, Vol. II

C. Kao, ed.
343 pp. IEEE, New York, 1981. $29.95

Optical fiber communication systems, which only a few years ago were considered nothing more than laboratory curiosities by many "hard-nosed" engineers, are at this moment being introduced into almost every area of telecommunication. As even more research and development effort is turned toward this area, three books have made timely appearances, each intended to fulfill a particular need different from the others and each succeeding in its mission. D. Personick's *Optical Fiber Transmission Systems* is a textbook oriented toward practical applications. *Optical Fiber Systems and Their Components*, by A. B. Sharma, S. J. Halme and M. M. Butusov, is a textbook with a decidedly academic leaning. C. Kao's *Optical Fiber Technology*, a collection of articles, is a handy reference.

Optical Fiber Transmission Systems covers a broad range of topics with impressive depth. Personick presents his material in a thorough, concise, yet entirely readable manner. Many practical "tips" and the liberal sprinkling of typical numerical values throughout the book make it useful for the novice system designer. The "specimen specifications" given from time to time ingeniously acquaint the reader with the state-of-the-art properties of optical transmission devices.


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While problem sets at the end of each chapter suggest that Personick intends the book to be an undergraduate text, an unevenness in the level of presentation is apparent. Chapters 1, 2, 4 and 5 are significantly more elementary than Chapter 3. There is also a disparity between the levels at which physical and electrical engineering concepts are presented. For example, while the critical angle of incidence is carefully defined, decibels are assumed to be known by the reader.

Chapters 1 and 2 provide excellent background for a qualitative understanding of optical fiber systems and a good background for the quantitative material in Chapter 3. Chapter 1 covers fibers and fiber making, propagation in fibers, LED and diode laser sources, positive–intrinsic-negative and avalanche-photodiode detectors. Chapter 2 discusses digital signal formats, error rates and practical constraints.

Chapter 3 is not as easily readable as the other chapters because of its high information density. The topics include transmitter design, receiver design, fundamental sources of noise and their properties and avalanche gain. Performance calculations are made for binary digital receivers, analog receivers and the impulse responses of fibers. The completeness of the presentation is marred somewhat by the omission of heterodyne detection.

In Chapters 4 and 5 Personick returns to the very readable style of the early chapters. Chapter 4 discusses modes and coupling of light into the fiber; source noise (both beat noise and mode hopping); delay distortion; tradeoffs between coupling efficiency, loss and delay distortion; and examples of typical systems (both digital and analog). Chapter 5 describes applications in telephone trunk plants, telephone loop plants, cable television and telemetry. Although the typical numerical values given for the parameters discussed are, in general, quite representative of the current state of the art, one exception occurs when the duct cost given in comparing optical fibers with conventional cables is too high, perhaps by more than an order of magnitude, and the conventional cable is undersized, by a factor of 2. The distorted values tend to bias the outcome of the comparison very strongly in favor of optical fibers.

Personick has written an excellent, readable introductory text for optical communication engineers. The in-depth analysis of system performance in Chapter 3 should become a classic in the field (which is only fitting since much of it is based on Personick's own

contributions).

The authors of *Optical Fiber Systems and Their Components* intend it to be an introductory text for engineers and physicists involved in optical fiber communications. Keeping their goal firmly in mind, they succeed admirably. Background material is generally complete. The numerous references given throughout the text, while not always as complete as one might desire, are well chosen. At the end of the book is a set of problems that are challenging, practical and well-conceived. The presentation of the material is consistently clear. However, occasionally the physics tends to be obscured by the mathematics. The only serious defect in the book—and it is a major one—is the unfortunate choice of type in which the book is set. I found it so difficult to read I would give serious consideration before inflicting it on a class of students. Springer should know better.

Following an introductory section, Chapter 2 provides a semiqualitative review of the physics describing the generation, modulation and detection of light. The treatment of modulation is quite good; the portion on detection, somewhat incomplete, treats avalanche gain a bit superficially. Chapter 3, reviewing the essentials of total internal reflection, treats light propagation in fibers in depth. Chapter 4 reviews the components that go into an optical fiber system. While it provides good treatments of the various types of optical fibers and lasers, it omits LEDs and long-wavelength detectors. Sections on shot noise are unnecessarily complicated whereas those on avalanche-detection noise are distinctly superficial.

Chapter 5 presents the fundamentals of fiber measurements clearly and concisely. A little more detail regarding the importance of launch conditions might be appropriate. Chapter 6 concludes the book with an analysis of the design and performance of optical fiber systems. Only here do the authors appear to be departing from their fields of expertise. For example, they contend that digital switching is the driving motivation for digital transmission. This claim is hard to justify since widespread use of digital transmission predates digital switching by two decades. While they give a clear and interesting description of pulse-code-modulation implementation they fail to state that their description applies only to systems authorized by the International Telephone and Telegraph Consultative Committee, which means that the section is inapplicable to PCM transmission systems in the US, Canada and Japan, where together at least 90% of all PCM systems are in service.

The present volume of *Optical Fiber Technology* is the second of the IEEE reprint series on the subject. (The first volume, published in 1976, was edited by D. Gloge). Charles K. Kao, selecting 35 from the nearly 2000 publications he reviewed, has done an excellent job, but one that obviously cannot satisfy everyone. Although topics are generaly covered well, I was troubled by neglect of single-mode fiber theory (in particular W-type fibers) and omission of the VAD process for fiber manufacture, and—with five papers devoted to applications—omission of the Bell System FT3 system. Of course the editor is severely constrained by the economic realities imposed by the publisher. Nevertheless, it appears that these topics could have been covered at the expense of eliminating certain papers of comparatively minor importance. For example, I wonder about the selection of the paper by U. C. Paek and R. B. Runk, on a detail of the drawing process of silica fibers, and of the paper by M. Boerner and S. Maslowski, which provides little more than routine speculations concerning construction of an optical fiber telecommunication plant. Most of all I doubt the usefulness of the brief summary by L. Dworkin, K. Trumble and D. Williams on the application to military systems.

The volume should be a useful addition to the library of anyone working in the field of optical fiber technology.

W. M. Hubbard
Bell Laboratories
Holmdel

Nuclear War: The Facts on Our Survival

P. Goodwin
128 pp. Ash and Grant, New York, 1981. $5.95

Energy/War: Breaking the Nuclear Link: A Prescription for Nonproliferation

A. B. Lovins, L. H. Lovins
164 pp. Harper & Row, New York, 1981. $3.95

Amory B. Lovins, an experimental physicist, energy policy analyst and British Representative of the environmental organization, Friends of the Earth, and L. Hunter Lovins, environmental lawyer and political scientist, have written a well-documented, persuasive book on the technical, socioeconomic and political connections between nuclear-power development and the proliferation of nuclear weapons. They argue, convincingly, that the intention of the Non-Proliferation Treaty—halting the spread of nuclear weapons capability—is unattainable if developed countries continue to promote nuclear power as the solution of the energy needs of developing countries. They do not suggest, conversely, that proliferation or the expansion of present nuclear weapons forces requires the simultaneous expansion of the nuclear-power industry. Rather they say that proliferation would be considerably more unlikely without it. Based on their conviction—that it is merely a matter of time before we all blow ourselves up if the nuclear arms race isn't ended—the authors of *Energy/War: Breaking the Nuclear Link* address the twin problems of meeting world-wide energy needs without nuclear power and organizing the monumental effort that will be needed to assure the dismantling of nuclear arsenals.

The analysis presented by the Lovins (well-known advocates of the "soft path" based on conservation and renewable energy strategies) concludes that not only is a non-nuclear energy future possible, but it is advantageous for both the developed and developing countries. They argue that nuclear power is irrelevant to the most pressing problem of oil displacement. Using a flood of statistics from many reputable sources, they demonstrate that investment in conservation and non-nuclear energy technologies is far more economical and will achieve much greater reductions in oil dependence for any nation faced with a decision about its energy future. Furthermore, they tell us that nuclear power is in a state of collapse and decline world-wide due to rapidly rising costs, technical problems and political problems.

Less convincing to this reviewer than the case against "nukes" are the prescriptions offered by the Lovins for promoting international energy policies based on conservation and renewable fuels and a program of world-wide nuclear disarmament. They reject central energy planning or direct governmental intervention in choosing an energy policy. The economic policies they do recommend are primarily designed to provide the investment capital for soft-path development and to neutralize the advantages of the subsidies long enjoyed by the fossil fuel and nuclear industries. They say little about how this can happen while the huge energy monopolies exert controlling influence. (For a contrasting treatment of this problem, the reader is referred to *The Sun Betrayed* by Ray Reece, Southdown Press.) With respect to disarmament, several suggested steps and strategies (none of them novel) are offered. These suggestions seem aimed at the leaders of the nuclear powers, who are likely to be a much less receptive audience than the organizers of the rapidly growing movements against nuclear armaments on both sides of the Atlantic.

In *Nuclear War: The Facts on Our Survival*, British scientist and journa-