DEPARTMENTS

BOOK REVIEWS

Optical Interconnection: Foundations and Applications

Christopher Tocci and H. John Caulfield, 383 pages, illus., bibliographic references, appendix, and index. ISBN 0-89006-632-9. Artech House, 685 Canton Street, Norwood, MA 02062 (1994) $79 hardbound.

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Optical interconnects have been an active and increasingly important area of research since 1984 within the broad topic recently termed "optics in computing." There have been a number of conferences and special issues of journals, such as *Optical Engineering* and *Applied Optics*, focusing on this topic. This book is one of the first books to concentrate on optical interconnects. As the name suggests, the book contains chapters devoted to fundamental aspects of optical interconnects as well as some devoted to specific applications. The nine chapters written by various experts in the research community are divided into three sections.

The first section termed "Motivational Aspect: An Introduction to Optical Interconnects" contains two chapters, a brief first chapter written by the editors, followed by a detailed second chapter written by Michael Feldman (University of North Carolina, Charlotte) analyzing the bottlenecks in electrical and optical interconnects at various interconnect levels within a computing system. Mike Feldman has done some of the early quantitative analysis on the comparison between electrical and optical interconnects. This chapter contains a more detailed and updated version of his earlier work and represents a valuable resource for a researcher in optical interconnects.

The second section termed "Current Optical Interconnect Approaches and Limitations" contains four chapters dealing with optical fiber interconnects by Ronald A. Nordin (AT&T Bell Laboratories), free space optical interconnects by Rick Morrison (AT&T Bell Laboratories), integrated optical circuits by Robert Shi (Alpha Photonics) and Tomasz Jannson (Physical Optics), and optoelectronic devices and packaging by Lynn D. Hutcheson (Raynet Corporation). The list of topics is appropriate and comprehensive and the authors are some of the leading researchers in their corresponding areas. Each chapter, however, has a very different flavor, with the chapter on integrated optics being most substantial (more than 80 pages) and almost like a textbook containing waveguide mode derivations. In contrast, Chaps. 3 and 6 discussing fibers and optoelectronics are much more descriptive, qualitative, and practically oriented. The chapter on free-space optics is rather thin and not sufficiently rigorous or detailed. Each of the chapters are, however, very useful in giving a beginning researcher a good feeling for these important areas.

The third section is called "Applications of Optical Interconnects" and contains three chapters. Chapter 7 discusses polymer waveguides and is written by Ray T. Chen (University of Texas, Austin) and Chap. 8 describes optical multiplexers for cryogenic sensors and is written by Christopher S. Tocci (Baird Corporation) and Stanley Reich (Grumman Corporation). The final chapter presents an architectural scheme for using 3-D optical interconnects for massively parallel computers and is written by William R. Michalson (Worcester Polytechnic Institute) and Eric G. Schneider (Quickware Engineering and Design, Inc.). Chapter 7 should be in the previous section on technical approaches, because it describes a specific variant of active and passive optical guided-wave devices made in polymers. It would have been more logical to combine this material with that in Chap. 5 and create two chapters, one devoted to waveguide theory and materials and the other describing different devices. In spite of the phrase "Application in Interconnects and Signal Processing," there is very little discussion of applications at the system or module level. Nonetheless, Chaps. 5 and 7 provide a very comprehensive picture of the different materials and device technologies in guided-wave optics that are currently being investigated.

The main topic of Chap. 8 is the use of optical multiplexers to obtain signals from a cryogenic sensor. The chapter contains nominal discussions of optical interconnects at the MCM and back plane level. The specific problem of cryogenic sensors, while important, does not quite fit within the framework for interconnects developed in the rest of the book, making this chapter somewhat out of place. Chapter 9 presents an analysis of various multistage interconnect networks when implemented with optical guided-wave devices. The use of an orthogonally oriented 1-D array of devices to implement 2-D interconnects is rather novel and speculative with very little experimental support as yet. Therefore the detailed analysis of various network architectures seems strangely out of place and not quite consistent with the "-ility" (reliability, manufacturability, etc.) checks laid down in the preface.

In summary, the book is very good in providing the fundamentals and technological options for optical interconnects. Its weakness is the discussion of applications, but this may be more an indication of the current state of research in optical increments than the obvious work that the authors and editors of the book put into the endeavor. I think that the book will be a worthwhile addition as a basic reference book. Readers should also be aware of an excellent book by H. Scott Hinton titled *An Introduction to Photonic Switching Fabrics* (Plenum Press, 1994) that covers the applications aspect of optical interconnects.