

# DEPARTMENTS

## BOOK REVIEWS

### Diode Laser Arrays

Dan Botez and Don R. Scifres, Eds., 448 pages, illus., references, and index. ISBN 0-52141-975-1. Book 11 in the series Cambridge Studies in Modern Optics, P.L. Knight and A. Miller, Series Eds. Cambridge University Press, 40 West 20th Street, New York 10011-4211 (1994) \$100 hardbound.

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This book is the eleventh in a series of distinguished books by Cambridge University Press on the aspects of modern optics. It is a quite complete review of both the theoretical and practical features of semiconductor diode laser arrays. It contains ten chapters contributed by knowledgeable authors on all key types of arrays, including coherent, incoherent, edge-emitting and surface-emitting, horizontal-cavity and vertical-cavity, individually addressed, lattice-matched, and strained layer.

The first five chapters concern coherent arrays, where historically, initial interest was in creating phase-locked arrays that delivered narrow high-power beams, for example, for free-space optical communications. Chapter 1, "Monolithic phase-locked semiconductor laser arrays," by Dan Botez of the University of Wisconsin, Madison, indicates that a key challenge has been to obtain single spatial mode operation from sizable apertures while maintaining stable diffraction-limited performance for power levels up to 1W. This chapter has 71 pages and 133 references (some from 1994). Chapter 2, "High-power coherent, semiconductor laser, master oscillator power amplifiers and amplifier arrays," by David F. Welch and David G. Mehuys of SDL Inc., San Jose, California, discusses both single-element performance and scalability of arrays. It

covers 51 pages and contains 53 references.

Chapter 3, "Micro-optical components applied to incoherent and coherent laser arrays," by James R. Leger of the University of Minnesota, Minneapolis, considers system aspects of laser arrays, particularly external optical components (such as lenslet arrays) that manipulate the array output to address specific applications. This chapter has 57 pages and 96 references. Chapter 4, "Modeling of diode laser arrays," by G. Ronald Hadley of Sandia National Laboratories, Albuquerque, New Mexico, provides an overview of modeling techniques that have been successfully used to explain array performance. It contains 46 pages and 62 references. Chapter 5, "Dynamics of coherent semiconductor laser arrays," by Herbert G. Winful of the University of Michigan, Ann Arbor, and Richard K. DeFreez of the Oregon Graduate Institute, Beaverton, reviews the "marvelous rich and complex" temporal behavior of laser arrays. This chapter has 29 pages and 36 references.

The remaining five chapters concern spatially incoherent arrays typically used as efficient pumps for solid-state lasers (with an emphasis on issues such as power capability, reliability, and practical packaging and pumping methodologies) and vertical cavity surface emitting and individually addressed arrays, which may have applications in optical processing, optical interconnects, and multichannel optical recording. Chapter 6, "High-average-power semiconductor laser arrays and laser array packaging with an emphasis on pumping solid-state lasers," by Richard Solarz, Ray Beach, Bill Benett, Barry Freitas, Mark Emanuel, George Albrecht, Brian Comanskey, Steve Sutton, and William Krupke of Lawrence Livermore Laboratory, Livermore, California, covers requirements for the fabrication of high-

average-power diode arrays, approaches to packaging, and the performance of devices fabricated to date with some reliability and lifetime results. This chapter has 39 pages and 40 references. Chapter 7, "High-power diode laser arrays and their reliability," by D. R. Scifres and H. H. Kung of SDL Inc., San Jose, California, describes the history of high-power diode laser research, failure mechanisms responsible for power limitations, reliability and environmental testing, and design considerations for long life at high power. It contains 42 pages and 164 references.

Chapter 8, "Strained layer quantum well heterostructure laser arrays," by James J. Coleman of the University of Illinois, Urbana, considers, for example, material aspects of strained layer heterostructure systems and the advantages of these systems in terms of increased wavelength range and enhanced reliability. This chapter has 32 pages and 130 references. Chapter 9, "Vertical cavity surface-emitting laser arrays," by Connie J. Chang-Hasnain of the University of Illinois, Urbana, focuses mainly on recent advances in 2-D VCSEL arrays, including design, fabrication, typical characteristics, and addressing and packaging. It contains 46 pages and 55 references. Chapter 10, "Individually addressed arrays of diode lasers," by Donald B. Carlin of the David Sarnoff Research Center, Princeton, New Jersey, describes the development of linear arrays of index-guided diode lasers and indicates future directions for this technology. It has 30 pages and 59 references.

Diode laser arrays have numerous and important current and potential uses, and the detailed review of their characteristics and applications provided in this book should be of high value to engineers and researchers in a variety of specialties.