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Preface

The Critical Reviews of Optical Science and Technology Series convenes a group of recognized experts, each of whom presents an extended invited paper on his or her specific field. The conference proceedings are intended to be an authoritative overview of the technology, including its developments, current status, and projections for future directions and challenges. These objectives have been amply realized by the excellent contributions to this conference. This volume is expected to be significantly referenced in the literature.

The increasing importance of optoelectronics and integrated optics is reflected by the intensive research being done in many laboratories worldwide. The major motivation that drives this R&D is the unique capability of lightwaves to transmit and to process optical information in very high bandwidths. One of the best examples is optical fiber transmission, which has played a major role in telecommunications. Such an optical fiber communications system consists of a number of discrete components connected together in a manner that enables them to perform a desired task. To enhance systems performance it is necessary that all the components within the transmission systems be compatible.

High-performance semiconductor electronic devices and photonic devices have been realized and demonstrated using advanced materials technology. The devices have been mature enough that they can be manufactured commercially for trunk telecommunications, local area networks, and cable TV distribution. More advanced optoelectronic and electronic devices are needed for incorporation into future communications systems. This imposes stringent requirements on performance, complexity, and cost. System optimization is very much affected by the need to keep these devices and interconnection costs to a minimum. The solution to this problem may lie in optoelectronic integrated circuits.

Over the past two decades advances in the areas of integrated optics and optoelectronics have resulted in the demonstrations of novel photonic devices and concepts. The use of various materials such as glass, $LiNbO_3$, $LiTaO_3$, compound III-V semiconductors, and polymers has resulted in the use of prototype photonic devices in advanced communications, signal processing, and sensor systems. This critical review summarizes significant advances in these fields and looks boldly into the future at the potential products and applications.

In addition to using optics for transmission of signals at high speed, optics can also be applied to information processing, using photons instead of electrons.

One of the intrinsic advantages of such a system is the parallel processing of information. This can dramatically increase the capacity of the systems to handle information. This indeed will involve multidisciplinary research in fields such as optical processing, nonlinear optical materials, spatial light modulators, and integrated optoelectronics.

We would like to thank all the contributors for their presentations and for taking the time to prepare their papers despite busy schedules. We would also like to thank all the session chairs and the program committee. The excellent organizational support of SPIE is also gratefully acknowledged.

M. Razeghi
Northwestern University

K.-K. Wong
Litton Systems, Inc.