Foreword to the Special Issue on Optical Guided Wave Technology

THIS Special Issue of the JOURNAL OF QUANTUM ELECTRONICS is the third in a series dedicated to optical guided wave technologies. The first two Special Issues were published in June 1981 and April 1982. The purpose of these three issues was to present the readership with an accurate snapshot of the technology, to illustrate the state-of-the-art and the research trends, and to provide a survey for the IEEE and the Optical Society as to the extent of activity in this field. The continued growth both of R&D and applications of guided wave technology has been made apparent by the responses to these special issues. As a consequence of this survey and as a result of the expressed interest of the memberships of the IEEE and the Optical Society, a new journal which is entitled, JOURNAL OF LIGHTWAVE TECHNOLOGY has been established. It is planned that this journal becomes the principal vehicle for the publication of works in guided wave related technologies. During the calendar year 1983, quarterly issues are planned, growing to at least bimonthly issues in 1984. Applications as well as technological developments are expected to be covered in this new journal.

This Special Issue on Guided Wave Technology is intended to review progress in the field via selected invited papers and to report on recent progress in componentry and subsystems. The papers presented herein provide a good overview of current research and development areas in optically guided waves. This Special Issue has been divided into the following six principal subsections: Optical Fiber Fabrication; Characterization and Testing; Fiber Optical Transmission; Waveguide Components; Fiber Optic Sensors; Diode Laser Technology; and Planar Waveguides.

In the first subsection on optical fiber fabrication and properties, there are four invited papers. The first two invited papers on fiber fabrication using vapor-phase axial deposition (VAD) and outside vapor deposition (OVD) methods describe two of the principal methods for fabrication used today. An invited paper in the April 1982 JOURNAL OF QUANTUM ELECTRONICS on modified chemical vapor deposition (MCVD) described a third widely used approach. The intent of these three papers is to give the reader a feeling for the state-of-the-art achieved using these approaches and an overview of the technical details. In the paper on VAD, the techniques used to fabricate guided index and single-mode fibers, special high NA fibers, and single polarization fibers are outlined. Manufacturing considerations are also discussed. The paper on OVD describes the manufacture of fibers using this process and compares this approach with inside vapor deposition and axial vapor deposition techniques. A third invited paper in this section covers the important area of determining the profile of fiber preforms, core diameters, index differences, and index profiles. Knowledge of these properties is required if one wishes to determine the performance characteristics of a fiber and modify this performance to meet certain requirements. The fourth invited paper discusses a longer term research trend in optical fibers, that is, the development of infrared transmitting fibers. This class of fibers offers lower transmission loss capabilities, lower radiation damage susceptibility, and optical power delivery capabilities. Oxide, halide, and chalcogenide material systems are examined and the state-of-the-art for each system is presented. Other papers in this section discuss techniques to characterize fibers, the characteristics of fibers, and the performance of polarization preserving fibers.

The second section covers topics in the area of fiber optic transmission. An invited paper entitled "A Comparison of Lightwave, Microwave, and Coaxial Transmission Technologies" describes the relative performance, complexity, and cost for these three digital transmission technologies. Tradeoffs exist between the three technologies as do advantages and disadvantages. The conclusion is presented that optical technology does indeed have technological advantages and that its place in the market place will expand. High-speed single-mode transmission results as well as signal/noise and error rate performance of repeatered fiber links are also presented in this section. Components designed for use in fiber optical systems are presented in the next section. Polarizers, connectors, and couplers of various designs and for various purposes are discussed in a series of contributed papers.

Papers in the fourth section present recent results in optical fiber sensor technologies. Trends in sensor signal demodulation and polarization effects on performance are outlined. Further examinations into transduction schemes are detailed in the papers on microbend and Fabry-Perot types of sensors. These papers update the recent invited review paper on fiber optic sensors that appeared in the April 1982 Special Issue of the JOURNAL OF QUANTUM ELECTRONICS.

Advances in diode laser technology are discussed in Section V. An invited paper entitled "Recent Developments in Monolithic Integration of Optoelectronic Devices in InP/InGaAsP" outlines work designed to integrate solid-state optical devices (sources and detectors) with high-speed microelectronic circuits. The performance characteristics of these optoelectronic circuits are presented, as are current trends in this area. The state-of-the-art in this research area can be obtained from this paper. Other papers describe various diode laser configurations and their performance, and the noise and pulse characteristics of semiconductor lasers. The final section is dedicated to planar waveguide technology. In this section, several papers report impressive results on waveguide switching and waveguide-to-fiber coupling.

Although this Special Issue cannot cover all aspects of fiber technology, it is intended to provide a collated collection of works which illustrate the state-of-the-art, technological trends, and potential of guided wave technology in optical

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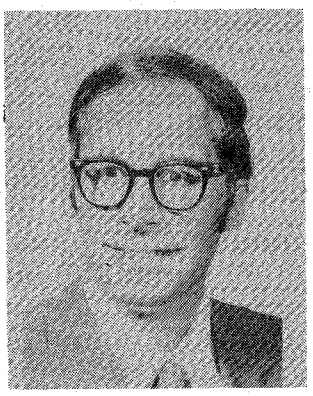
communications. It is a certainty that this field will continue to grow and that the technology will find its way into even more applications.

I would like to extend my thanks to all of those scientists and engineers who have submitted manuscripts to this and the preceding two Special Issues of the JOURNAL OF QUANTUM ELECTRONICS. The papers presented in these issues are truly a credit to all of the authors and I hope the readers have found these issues instructive and useful. I would also like to acknowledge the time and effort so generously contributed by all of the reviewers. My sincerest thanks go to T. Johnson who assisted me in performing all the duties required of a JOURNAL Editor.

THOMAS G. GIALLORENZI
Guest Editor



Thomas G. Giallorenzi (SM'78) was born in New York, NY, on February 28, 1943. He received the B.S. and M. S. degrees in engineering physics and the Ph.D. degree in applied physics from Cornell University, Ithaca, NY, in 1965, 1966, and 1969, respectively. At Cornell University, he worked on theoretical and experimental aspects of optical parametric scattering.

From 1969 to 1970 he was with the General Telephone and Electronics Laboratories, Inc., where his research was on plasma processes in gaseous lasers and arc lamps. In November 1970 he joined the Naval Research Laboratory, Washington, DC. His research has included studies of Raman and parametric scattering, optical parametric oscillators, dye lasers, and fiber and integrated optics. From September 1977 to September 1979 he headed the Optical Techniques Branch. Since July 1979, he has headed the Optical Sciences Division, which conducts research in all aspects of optical and electrooptical research. He has authored or coauthored over eighty journal publications and holds over twenty U.S. patents and has more than twenty pending.

Dr. Giallorenzi is a member of the American Physical Society and is a Fellow of the Optical Society of America. He received the Research Society of America Award for Applied Science in 1973 and the Navy's Meritorious Civilian Service Award in 1978.