

Emerging optoelectronic technologies

Foreword

Although optical communication was demonstrated by Alexander Graham Bell through his *photophone* experiment based on sunlight way back in 1880, this area did not find favour for practical use due to the nonavailability of a man-made source of monochromatic coherent radiation. However, the invention of such a source, viz., laser in the early 1960's, followed by the development of a semiconductor laser and the great strides in microelectronics in the same period have heralded *optoelectronics* as a key interface area between electronics and optics, and kindled interest once again in optical communication. Today, with the penetration of digital techniques in communication and the availability of low-loss optical fibres, high reliability semiconductor lasers, photodetectors and most of the electronic functions in LSI/VLSI form, lightwave communication has already become the backbone of modern communication technology. Besides its crucial role in transmission and switching in modern communication, optoelectronics is also important in several other areas, such as, information generation, processing and storage, computing and instrumentation, and is attracting considerable scientific and technological effort around the world. Not only are novel phenomena, new materials and fabrication technologies being investigated and new devices/ICs being developed, but optoelectronic systems, in general, and lightwave communication systems, in particular, are also being regularly advanced and updated.

Looking at these developments and the influence of the emerging optoelectronic technologies on science, technology, industry and services in India, an international conference on Emerging Optoelectronic Technologies was organized at the Indian Institute of Science, Bangalore, during December 16–20, 1991, under the sponsorship of SPIE – the International Society for Optical Engineering (USA) and the Jawaharlal Nehru Centre for Advanced Scientific Research (India). Over 150 papers were presented on all major aspects of optoelectronics in the 27 sessions at the conference, which also had 5 tutorial courses in this area to back up the programme. A small selection of ten invited papers at this conference has been organized in this special issue to provide the reader with a flavour of the emerging optoelectronic technologies in India and abroad.

The issue begins with a presentation on “Optoelectronics—past, present and future” by C K N Patel, which gives an excellent review of progress in this field, brings us to the current state-of-the-art and provides an insight into likely future developments. The next paper by G A Evans *et al* covers “Surface emitting semiconductor lasers and laser arrays”, in which the authors have particularly emphasized the recent progress in grating-coupled surface emitting (GSE) lasers. In the third paper, G Guekos & D Syvridis have presented their study on “Polarization behaviour of diode lasers with frequency selective feedback”, which is particularly attractive for applications in optical metrology, spectroscopy and communication.

“InGaAs *p-i-n* photodiodes for fibre-optic communication” is the theme of the next paper presented by D N Bose & Arvind Kumar, in which the authors have highlighted their experimental work and results. In the following paper, “Integrated optics – technology and applications” by A Selvarajan, technologically important developments in photonics including materials, processes, device technology and applications are covered. Vittorio Ghergia in his paper on “Optoelectronic devices towards monolithic integration” has presented an overview of optoelectronic devices, particularly for telecommunications, and given future perspectives in this area. Yet another area of significance viz., “Integrated optoelectronics for optical interconnections and optical processing” has been covered by Osamu Wada in which he has brought out the importance of synergetic collaboration among materials and processing, design and fabrication as well as packaging areas for realising practical optical interconnections and signal processing systems. R V Ramaswamy and Xiaofan Cao in their paper “Second-order quasi phase-matched second harmonic generation in annealed proton exchanged LiNbO₃ channel waveguides” have discussed blue light generation with high conversion efficiency, which is of considerable importance in optoelectronics. The usefulness and advantages of optoelectronics in spacecraft applications have been brought out in the following paper by T K Alex on “Optoelectronics in satellite designs”, wherein the Indian experience in this important area has been described. In the last paper, R P Jindal has covered “Noise considerations in the design of long haul lightwave communication system” and explained the concepts and also reviewed the current status of this rapidly evolving field.

It is our earnest hope that the collection of papers included in this special issue will be useful in introducing the emerging optoelectronic technologies to the scientific and engineering community at large.

I would like to express my grateful thanks to the Editorial Board of *Sādhanā*, in particular to Professors R Narasimha and N Viswanadham, for inviting me to organise this special issue, which I have enjoyed immensely.

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B S Sonde
Guest Editor