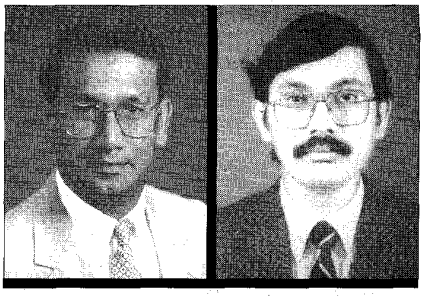
Optical Networks, Communications Systems, and Devices



M. Atiquzzaman M. A. Karim

The demand for bandwidth in networks is increasing at a tremendous rate. Optical networks and communication systems, having enormous transmission capacity and bandwidth, are being exploited to obtain a quantum leap in communication bandwidth. The high bandwidth of optical fiber along with a low error rate as compared to other transmission media makes it very attractive for the emerging broadband networks which rely on the above criteria for communications. Optical communication networks are becoming the backbone of both national and international telecommunications networks. Optical communications systems are being commissioned within both the access and the local area to facilitate the broadband communication requirements for both business and home users. Recently there has been lot of work in designing optical networks and communication systems, and developing techniques to exploit the potentially unlimited bandwidth of optical networks and communication systems.

Wavelength-division multiplexing (WDM), where different channels are transmitted at different wavelengths, can be used to exploit the enormous bandwidth of optical networks and communication systems. Optical networks and communication systems differ from electronic systems in many respects, and give rise to a range of issues which are different from conventional electronic systems. The articles in this Feature Topic discuss some of the issues, such as optical switching, medium access control, multicasting, and photonic transport networks.

The first article (Pan *et al.*) discusses optical switches which can switch data at a much higher rate than electronic switches. The authors discuss the characteristics of optical multistage switches working in the circuit switch mode. They also review the problems associated with crosstalk in optical switches and methods to avoid crosstalk.

The second article (Marsan *et al.*) considers medium access control in a WDM network where a logical channel is used for each destination node in the network. Each node has a tunable transmitter to select the destination node, and a fixed receiver to receive information from other nodes. A dedicated channel for each destination node gives rise to the need for a medium access control protocol to arbitrate access to the shared channel. The authors discuss the access scheme, fairness, and reservation strategies (guaranteed and best effort applications) of a medium access protocol. Performance results of the protocol are presented.

Multicasting among the nodes of an optical network is discussed in the third article (Sahasrabuddhe *et al.*). The authors discuss the application and advantages of light trees as a multicasting technique. They also discuss a multicast-capable wavelength-routed switch architecture which will support the multicasting technique. Both unicast and broadcast traffic are considered in the article.

The last article (Yoshimura *et al.*) discusses future photonic transport of data over optical communication systems. It provides an excellent introduction to photonic transport networks and related issues such as WDM, fiber amplifiers, optical frequency accuracy, and so on. They also discuss implementation issues of long-haul and large-capacity fiber transmission systems. Sophisticated optical processing devices and functions will be required to fully reap the benefits of photonic technologies.

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Editorial Liaison: G.S. Kuo

BIOGRAPHIES

Mohammad A. Karim [SM] is professor and head of the Electrical Engineering Department at the University of Tennessee in Knoxville. He received his B.S. in physics in 1976 from the University of Dacca, Bangladesh, and M.S. degrees in both physics and electrical engineering, and a Ph.D. in electrical engineering from the University of Alabama in 1978, 1979, and 1981, respectively. He is active in research in the areas of optical information processing, pattern recognition, optical computing, displays, and EO systems. He is the author of four text books, eight book chapters, and over 250 papers. He serves on the editorial boards of three engineering journals and has been a guest editor of eight journal special issues. He is a Fellow of both the Optical Society of America (OSA) and Society of Photo-Instrumentation Engineers (SPIE).

Mohammed Atiquzzaman (atiq@ieee.org) received the M.Sc. and Ph.D. degrees in electrical engineering and electronics from the University of Manchester Institute of Science and Technology, U.K. Currently he is faculty member in the department of Electrical & Computer Engineering at University of Dayton, Ohio. He is a senior editor of the IEEE Communications Magazine and serves on the editorial boards of the Computer Communications journal and Telecommunication Systems journal. He has guest edited many special issues of various journals including feature topic on Switching and Traffic Management for Multimedia in the IEEE Communications Magazine, special issues on ATM Switching and ATM Networks of the International Journal of Computer Systems Science & Engineering, Next Generation Internet in the European Transactions on Telecommunications. He has also served in the technical program committee of many national and international conferences including IEEE INFOCOM and IEEE Globecom. His current research interests are in Broadband ISDN and ATM networks, multimedia over high-speed networks, and ATM switching. He has over 90 refereed publications.