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Recent Progress on Waveguide Device Design and Its Applications

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Integrated-optic waveguide devices become more and more complicated to realize high functionality. Channel numbers of arrayed-waveguide gratings (AWGs) have been dramatically increased up to 400ch in single wafer. In the multi-chip configuration, 4200ch has been achieved with 5GHz channel spacing. Optical functional devices are important to solve electrical bottleneck issues.

Though silica-based waveguides are simple circuit elements, various functional devices are fabricated by utilizing spatial multi-beam or temporal multi-stage interference effects such as AWGs and lattice-form programmable filters.

Various kinds of optical-layer signal processing devices have been developed; they are reconfigurable optical add/drop multiplexers (ROADM), wavelength selective switches (WSS), dispersion compensators, PMD equalizers, dynamic gain equalizers, optical label recognition circuits, temporal pulse waveform shapers, and etc.

Ultra-compact and CMOS compatible silicon waveguides are important for the integration of an optical component and an electronic circuit aiming at higher level of functionalities.

Hybrid integration technologies with LiNbO3, InP, MEMS, and polymer will further enable us to realize much more functional and high-speed devices.

This talk reviews the recent progress and future prospects of waveguide device design and its application to trunk communication systems, FTTH access networks and photonic signal processing applications.

Biography

Katsunari Okamoto

Katsunari Okamoto was born in Hiroshima, Japan, on October 19, 1949. He received the B.S., M.S., and Ph.D. degrees in electronics engineering from Tokyo University, Tokyo, Japan, in 1972, 1974, and 1977, respectively.

He joined Ibaraki Electrical Communication Laboratory, Nippon Telegraph and Telephone Corporation (NTT), Ibaraki, Japan, in 1977, and was engaged in the research on transmission characteristics of multimode, dispersion-flattened single-mode, single-polarization (PANDA) fibers, and fiber-optic components. He proposed for the first time the dispersion-flattened fiber (DFF) and succeeded in fabrication of DFF that had chromatic dispersion less than +/-1 ps/km/nm over a wide spectral range.

From September 1982 to September 1983, he was invited as a guest researcher to Optical Fiber Group, Southampton University, England, where he was engaged in the research on birefringent optical fibers.

From October 1987 to October 1988, he stayed at RCAST (Research Center for Advanced Science & Technology) of University of Tokyo as Associate Professor with Dr. E. A. J. Marcatili from AT&T Bell Laboratories.

Since 1990, he worked on the analysis and the synthesis of guided-wave devices, the computer-aided-design (CAD) and fabrication of silica-based planar lightwave circuits (PLCs) at Ibaraki R&D Center, NTT Photonics Laboratories. He has developed a 256x256 star coupler, various kinds of AWGs ranging from 8ch-300nm spacing AWGs to 128ch-25GHz AWGs, flat spectral response AWGs and integrated-optic reconfigurable add/drop multiplexers (ROADM). 200 GHz to 50 GHz spacing AWGs are now widely used in the commercial WDM systems.

From July 2006, he serves as Professor of Electrical and Computer Engineering at the University of California at Davis (UC Davis). His research at UC Davis includes passive and active photonics devices for high-performance all optical networks.

He has published more than 240 papers in technical journals and international conferences. He authored and co-authored 8 books including “Fundamentals of Optical Waveguides (Elsevier)”.

Dr. Okamoto is a member of the Institute of Electrical and Electronics Engineers (Fellow), Optical Society of America and the Institute of Electronics Information and Communication Engineers of Japan.