Preface

The growth of Internet traffic in recent years surpassed the prediction of one decade ago. Data stream in individual countries already reached terabit/s level. To cope with the petabit class demands of traffic in coming years the communication engineers are required to go beyond the incremental improvement of today’s technology.

A most promising breakthrough would be the introduction of modulation formats enabling higher spectral efficiency than that of binary on–off keying scheme, virtually the global standard of fiber-optic communication systems. In wireless communication systems, techniques of high spectral density modulation have been well developed, but the required techniques in optical frequency domain are much more complicated because of the heavier fluctuation levels. Therefore the past trials of coherent optical modulation/detection schemes were not successful. However, the addition of high-speed digital signal processing technology is the fundamental difference between now and two decades ago, when trials of optical coherent communication systems were investigated very seriously. This approach of digital coherent technology has attracted keen interest among communication specialists, as indicated by the rapid increase in the pioneering presentations at the post-deadline sessions of major international conferences. For example, 32 terabit/s transmission in a fiber experiment based on this technology was reported in post-deadline session of Optical Fiber Communication Conference (OFC) 2009. The advancement of the digital coherent technologies will inevitably affect the network architecture in terms of the network resource management for the new generation photonic networks, rather than will simply provide with huge transmission capacity.

In order to discuss about the merits and the challenges of various modulation/detection schemes enabling high spectral density transmission, an international workshop was organized under the sponsorship of NICT. “International Workshop on High Density Optical Communication” was held in Tokyo Japan, June 25–26, 2008. Pioneering researchers from all over the world attended the workshop and discussed a wide range of topics from device, modulation format, sub-system, and transmission systems. The presentations and discussions were very successful and we decided to publish a book, in which individual invited speakers contribute to the relevant chapters/sections by extending their views.

The book is aimed at providing with extensive overviews on the theoretical and the experimental aspects of high spectral density optical communication technology,
which should be a most promising approach for the new generation large capacity photonic network. Potential readers include researchers in the fields of communication, photonics, microwave, integrated circuits, and network architecture. The book will be useful also to the planners of future info-communication systems either in the industry, public institutions, or universities. The book covers the principles and the historical background of coherent transmission, so it should be valuable for university students at graduate level, who wish to be acquainted with the frontier of optical communication.

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