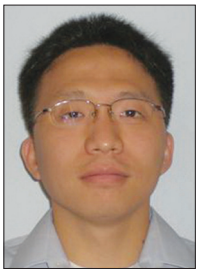
ADVANCES IN OPTICAL COMMUNICATIONS AND NETWORKING TECHNOLOGIES


Xiang Liu


Zuqing Zhu

Optical communications and networking technologies have been playing an increasingly important role in interconnecting a large variety of IT resources over globally distributed autonomous network systems, to facilitate cost-effective information exchange and data processing. In 2018, with the emergence of fifth generation (5G)-oriented optical transmission and access networks, we witnessed optical communication networks becoming more adaptive and reconfigurable to support dynamic optical service provisioning, protection, and restoration, and to deliver short time to market and cost-effective services and solutions. Following this trend, we expect to observe continued expansion of optical transmission and access networks and faster convergence of optical and wireless infrastructures in 2019.

In this first Optical Communications Networks Series (OCNS) issue of 2019, we have selected three contributions that address large-scale reconfigurable mesh optical networks, next-generation passive optical networks (PONs), and high-capacity digital radio over fiber systems.

In the first contribution, "Toward Terabit Digital Radio over Fiber Systems: Architecture and Key Technologies," L. Zhang *et al.* present the terabit digital radio over fiber system that utilizes large-capacity multi-core fiber (MCF) transmission, self-homodyne coherent detection, and compression quantization, namely, the digital RoMCF system. Through operation principle analysis and experiment demonstrations, the authors show that the digital RoMCF system has great potential to support future massive deployment of broadband radio applications, such as 5G communications and high-definition videos for terrestrial television networks. Their discussions also suggest that by leveraging the application-specific integrated circuit (ASIC) for digital signal processing in the digital RoMCF system, they might be able to further reduce latency and complexity in the future.

In the second contribution, "Evaluation of Dynamic Optical Service Restoration on a Large-Scale ROADM Mesh Network," C. Zhang *et al.* present an examination of dynamic optical service restoration on a large-scale ROADM network operated by China Telecom in the middle and lower Yangtze River region of China. Through both simulation-based assessment and live network experiments, the authors show that with an innovative wavelength-switched optical network (WSON) control plane, full service restorability can remain achievable even in the face of four or more concurrent fiber cuts in real network deployments. This article further posits that service times to restore and restoration conflicts and failures might be improved if network survivability assessment is operated in concert with centralized path computation applications.

In the third contribution, "Optical- and Electrical-Domain Compensation Techniques for Next-Generation Passive Optical Networks," Z. Zhang *et al.* present the next-generation PON schemes and the principles of a few different compensation techniques. They propose filter type optical compensation and Volterra type electrical compensation techniques to compensate nonlinear inter-symbol interference caused by vestigial sideband, limited modulation bandwidth, in-phase and quadrature imbalance, dispersion, and square-law detection. The article also compares various optical- and electrical-domain compensation schemes in terms of their equilibrium performance, features, characteristics, and applicability.

This issue marks the beginning of the new OCNS, which was transformed from the previous Optical Communication Series (OCS) published over the last few years. It is our great pleasure to continue serving as the Series Editors. With the continuing support of our authors and reviewers, and valuable feedback from our readers, we are confident that OCNS will become a valuable addition to *IEEE Communications Magazine* by covering advances in the field of optical communications networks and applications.

BIOGRAPHIES

XIANG LIU [F'17] (xiang.liu@huawei.com) received his Ph.D. degree in applied physics from Cornell University in 2000. He is currently the senior director of Optical Access Networks Research at Futurewei Technologies, focusing on next-generation optical access technologies. He spent the early part of his career at Bell Laboratories in New Jersey, working on high-speed optical fiber transmission technologies. He is a Fellow of the OSA and a Deputy Editor of *Optics Express*.

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