Forward of special issue on “Optical Network Architectures, Systems and Applications”

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The traffic demands keep increasing rapidly due to the growing number of broadband users and the existing and upcoming applications available to the end users. In addition, the enormous increase in on-line content and video traffic offered by the Internet is expected to continue. As optical technology can inherently support very high capacities, it is clear that it will continue to expand and play a central role in the future telecommunication networks. This special issue addresses major advances in optical networking in the area of network architectures, switching and routing, and IP/WDM integration.

With rapid advances in optical enabling devices and systems, multi-terabit transport networks have become a reality. In particular, in long-haul networks advanced dense wavelength-division multiplexing (DWDM) technology is currently widely introduced. Transmission technologies based on DWDM systems allow transmitting information with speed of Tb/s on a single fiber. To facilitate this enormous transmission volume the deployment of high-capacity and high-speed network nodes in the optical network becomes inevitable.

Waveband switching, optical circuit switching, optical burst switching (OBS) and optical packet switching (OPS) are promising technologies for harnessing the bandwidth of WDM optical fiber networks in a highly flexible and efficient manner. As a number of key optical component technologies approach maturity, photonics in switching is becoming an increasingly attractive and practical solution for the next-generation of optical networks.

Moreover, optical networks are inherently more energy-efficient than their electronic counterparts due to their ability to treat large data streams in a transparent way, i.e., without O/E/O conversion. Despite this advantage, there is still a lot that can be done to reduce the energy footprint of optical networks. Therefore, there is a growing interest in energy-efficient solutions for low-carbon optical networks and systems.

Five papers are accepted for publication in this special issue. In the first paper, the authors present a survey of WDM network reconfiguration with a focus on topology migrations and their impact on service disruptions. In the second paper “Physical-aware Long Reach PON Planning”, the authors present mathematical model to capture the internal constraints in cascade splitter scenarios in planning in long reach passive optical networks. In the third paper “Bandwidth-Variable Optical Transport Network with Adjustable Time-Modulated and Inverse-Multiplexed Wavelength Channels”, Oliver Yu, Huan Xu, and Ming Liao propose an architecture of bandwidth-variable and optical-groomable transport network. In the fourth paper “Dynamic Bandwidth Allocation in Heterogeneous WDM EPONs”, the authors propose two algorithms for ONU scheduling for WDM EPON with heterogeneous round trip times (RTTs). In the fifth paper, J. Domzal proposes and analyzes flow-aware resilient ring.

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