



**THE CHINESE UNIVERSITY OF HONG KONG**

Department of Information Engineering

*IEEE Photonics Society Distinguished Lecture*



## **Switching technologies for spatially and spectrally flexible optical networks**

by

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**Date : 10 July, 2015 (Fri.)**

**Time : 11:00am - 12:00noon**

**Venue : Room 833, Ho Sin Hang Engineering Building  
The Chinese University of Hong Kong**

### Abstract

Today's fiber-optic communication networks span the globe, delivering broadband information across all market segments and connecting massive datacenters, businesses, and individual user's homes. As such, optical networks must operate reliably and efficiently when transporting the massive information capacity of the Internet, allowing networks to adapt to growing and changing demand flows and occasional interruptions. Wavelength-selective switches (WSS) have been instrumental in fulfilling this role, enabling all-optical spectral routing of individual wavelength-division multiplexed (WDM) communication channels at network nodes.

The recent introduction of space-division multiplexing (SDM) to the optical communication domain with new fiber types, in order to economically support the exponentially growing capacity, necessitates complementary components for implementing SDM-WDM optical networks. SDM is typically realized with either multi-core or few-mode fibers and great capacity achievements have been demonstrated to-date in each fiber solution. Wavelength-selective switching functionality for these two fiber types has recently been introduced. A joint-switching WSS concept has been realized for multi-core fibers, enabling information to be encoded and routed on the SDM-WDM optical network as a spatial super-channel (single wavelength channel spanning multiple cores). This spatial super-channel routing concept with joint-switching WSS also extends to few-mode fibers. Hence a single WSS can then be used in analogous fashion to the single-mode fiber networks, thereby heralding the cost-savings benefits of SDM. A WSS with direct few-mode fiber interfaces has been demonstrated with the few-mode beams routed in free-space just as the single mode beam does in a conventional WSS. A study on the pass band filtering effect and mode mixing due to the spectral switching of dispersed components revealed the spatial-spectral interplay in the mode-dependent loss attributes of the few-mode fiber WSS. Such advanced WSS prototypes will serve the next generation transport networks when SDM is fully adopted by carriers.

### Biography

Dan M. Marom is an Associate Professor in the Applied Physics Department at Hebrew University, Israel, heading the Photonic Devices Group. He received the B.Sc. Degree in Mechanical Engineering and the M.Sc. Degree in Electrical Engineering, both from Tel-Aviv University, Israel, in 1989 and 1995, respectively, and was awarded a Ph.D. in Electrical Engineering from the University of California, San Diego (UCSD), in 2000.

His 20 year research career in optical communications started during his Master's degree, where he investigated free-space, polarization rotation based bypass-exchange (2x2) space switches, which later on led to the founding of a start-up company. In his doctoral dissertation he demonstrated real-time optical signal processing using parametric nonlinearities applied to spectrally dispersed light, for possible modulation and detection schemes in serial ultrafast communications (tera-baud rate and beyond). From 2000 until 2005, he was a Member of the Technical Staff at the Advanced Photonics Research Department of Bell Laboratories, Lucent Technologies, where he invented and headed the research and development effort of MEMS based wavelength-selective switching solutions for optical networks. Since 2005, he has been with the Applied Physics Department, Hebrew University, Israel, where he is now an Associate Professor leading a research group pursuing his research interests in creating photonic devices and sub-systems for switching and manipulating optical signals, in guided-wave and free-space optics solutions using light modulating devices, nonlinear optics, and compound materials.

Prof. Marom is a Senior Member of the IEEE Photonics Society, and a Member of the Optical Society of America. From 1996 through 2000, he was a Fannie and John Hertz Foundation Graduate Fellow at UCSD, and was a Peter Brojde Scholar in 2006-2007. He currently serves as Senior Editor for Photonics Technology Letters, handling photonic devices related submissions.

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