

6th International Conference on Photonics & 7th International Conference on Laser Optics

July 31- August 02, 2017 Milan, Italy



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Progress on microwave photonic signal processing and transmission

Microwave photonics (MWP) provides a unique way to synthesize, deliver and process radio frequency (RF) signal. Thanks to its numerous advantages like low transmission loss, immunity to electromagnetic interference and high bandwidth handling capacity, it is being rapidly applied into radar, satellite communication and metrology. Herein, we would like to introduce some new progresses of our research, which basically includes signal transmission, processing and detection. We proposed some methods to improve the spurious-free dynamic range of microwave photonic link (MPL), such as destructive combination of nonlinear distortions in a balanced photodiode, optical carrier band processing achieved by Stimulated Brillouin Scattering (SBS) processing and Sagnac interferometer-assisted dynamic range improvement strategy. These methods can greatly enhance the fidelity of microwave signal transmitted via an optical link, enabling realization of higher capacity with lower distortion signal transmission. We also developed some photonic techniques to eliminate in-band self-interference exists in Full-Duplex wireless communication system. We have developed a technique of optical RF self-interference cancellation by using the inherent out of phase property between the left and right sidebands of phase-modulated signal, matching their phase and amplitude to achieve self-interference cancellation. Another technique is based on a compact Dual-Parallel Mach-Zehnder Modulator (DPMZM), by detuning the electrical delay line and three bias voltage of DPMZM, the self-interference in received signal can be greatly suppressed. This work offers the possibility to achieve reliable full-duplex communications. Another work we have done is detection of low-power RF signal. It is based on a tunable optoelectronic oscillator (OEO), which can provide gain to the weak RF signals that match the oscillation frequency by tuning the wavelength of the laser. Throughout this work, it is just part of our work on MWP, further research still need to be done in the future.

Biography

Mingshan Zhao received his PhD degree in Electronic Engineering from Ghent University, Belgium, in 2003. He is a Professor in the School of Physics and Optoelectronic Engineering, Dalian University of Technology, Dalian, China. He leads the Photonics Research Center at DUT, which focuses on new concepts for microwave photonic components and systems, polymer-based photonic components, and circuits for optical communication and optical sensing.

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