Linear signal processing using silicon micro-ring resonators

Peucheret, Christophe; Ding, Yunhong; Ou, Haiyan; Xiong, Meng; An, Yi; Lorences Riesgo, Abel; Xu, Jing; Ozolins, Oskars; Hu, Hao; Galili, Michael; Huang, Bo; Pu, Minhao; Ji, Hua; Seoane, Jorge; Liu, Liu; Zhang, Xinliang

Published in:
POEM/IONT Technical Digest

Link to article, DOI:
10.1364/IONT.2012.ITh5B.1

Publication date:
2012

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
Peucheret, C., Ding, Y., Ou, H., Xiong, M., An, Y., Lorences Riesgo, A., ... Zhang, X. (2012). Linear signal processing using silicon micro-ring resonators. In POEM/IONT Technical Digest (pp. ITh5B.1 ). Optical Society of America. DOI: 10.1364/IONT.2012.ITh5B.1
Linear signal processing using silicon micro-ring resonators

Christophe Peucheret1, Yunhong Ding1, Haiyan Ou1, Meng Xiong2,1, Yi An1, Abel Lorences Riesgo1, Jing Xu1, Oskars Ozolins3,1, Hao Hu1, Michael Galli3, Bo Huang2,1, Minhao Pu1, Hua Ji1, Jorge Seoane1, Liu Liu1 and Xinliang Zhang2

1 DTU Fotonik, Technical University of Denmark, DK-2800 Kgs. Lyngby, Denmark
2 Wuhan National Laboratory for Optoelectronics, 430074 Wuhan, China
3 Telecommunications Institute, Riga Technical University, LV-1048 Riga, Latvia
4 South China Normal University, 510006 Guangzhou, China
cpeu@fotonik.dtu.dk

Abstract: We review our recent achievements on the use of silicon micro-ring resonators for linear optical signal processing applications, including modulation format conversion, phase-to-intensity modulation conversion and waveform shaping.

Silicon micro-ring resonators (MRRs) are compact and versatile devices whose periodic frequency response can be exploited for a wide range of applications, the most straightforward being periodic filters, add-drop multiplexers or wavelength selective switches [1]. Recently, we have exploited the design flexibility of MRRs in order to demonstrate spectral and temporal signal shaping. In particular, MRRs can be used for optical modulation format conversion from return-to-zero (RZ) on-off keying (OOK) to non-return-to-zero (NRZ) OOK [2]. This technique has been used for multi-channel format conversion, but also for the first ever demonstration of NRZ signal generation at 640 Gb/s by conversion of an optical time division multiplexed (OTDM) signal [3]. It has also been extended to format conversion from RZ differential phase-shift keying (DPSK) to NRZ-DPSK [4]. Another application of MRRs is for the demodulation of DPSK signals [5]. Other temporal shaping demonstrations include the generation of ultra-wideband monocycle pulses [6] as well as the enhancement of the modulation speed of directly modulated lasers [7].

Even though silicon MRRs are promising devices, they suffer from inherent polarization sensitivity, which is a critical impediment to their practical use. We will show how polarization diversity circuits based on polarization splitters and rotators can be engineered to significantly reduce their polarization sensitivity and illustrate the benefit of such circuits with the example of an MRR-based DPSK demodulator [8].

References