J Laser Opt Photonics 2017, 4:2(Suppl)
DOI: 10.4172/2469-410X-C1-012

Photonic generation and processing of wideband radio frequency signals in radar system

Fangzheng Zhang
Nanjing University of Aeronautics and Astronautics, China

The growing demand for high resolution target detection and imaging requires a radio-frequency (RF) radar to operate with a high-frequency and a broad bandwidth, giving great challenges to state-of-the-art pure electric systems. Microwave photonic technologies have been proposed as a promising solution for the generation, detection, and processing of high-frequency RF signals, taking advantage of the high spectral purity of the available optical laser sources and of the broadband operation provided by optical components. In this talk, we introduce our work on photonic RF signal generation in radar transmitter and photonic RF frequency conversion in the receiver. The aim is to achieve high resolution target detection and imaging by applying high-frequency and wideband RF signals while keeping a realizable electric analogy-to-digital converter and digital signal processing unit after microwave photonic frequency down-conversion. In the transmitter, photonic generation of linearly frequency modulated (LFM) RF signals is considered. The methods include frequency heterodyning of differently phase-modulated optical carriers, RF frequency multiplication based on advanced electro-optical modulation and frequency sweeping of P1 oscillation of an injected semiconductor laser. Quality of the generated signals is evaluated in aspect of maximum frequency and bandwidth, chirp rate, spectral purity and pulse compression capability, etc. In the receiver, microwave photonic frequency down-conversion or de-chirp of wideband LFM signals based on electro-optical modulation is presented and analyzed. The results confirm the good performance of microwave photonic techniques, which would play an important role in future radar system.

zhangfangzheng@nuaa.edu.cn