

Low-frequency photonics-based broadband radar imaging and sensing



THE UNIVERSITY OF SYDNEY

[2020-004]

A technology that adds low cost and simple architecture to the existing advantages of photonics-based radar.



> TRL 7-9

Problem

Applications such as security inspection, internal testing, autopilot, and target identification rely on radars that demand precise ranging and high spatial resolution. Achieving these requirements necessitates operating radars at high frequencies with broad bandwidth. However, conventional electronic-based systems and emerging photonics-based systems can fulfill these demands, albeit with escalating costs and complexity.

Solution

Presenting a photonics-based radar system capable of delivering high performance through low-megahertz frequency optical electronics. This system utilises a frequency-shifting fibre optic loop and a continuous wave laser beam to generate stepped frequency waveforms across a wide range of frequencies. A portion of the transmitting signal is directed into an electro-optic modulator, where it is modulated by the received signal and then filtered by an optical bandpass filter. The filtered signal is subsequently converted into an electrical signal by an optoelectric converter, sampled by an analogue-to-digital converter, and processed by a digital signal processing unit.

This technology enhances the existing benefits of photonics-based radar with its low cost and simplified architecture. It has the potential to reduce the cost of current radar applications such as synthetic aperture radar (SAR) imaging, ground penetrating radar, and multiple-input and multiple-output (MIMO) radar. Alternatively, the system's precision in the millimetre range and its penetration capabilities enable monitoring of vital signs such as respiration rate, heart rate, and blood pressure in living targets.

Intellectual Property Status

This IP is wholly Sydney-owned and is protected by International PCT patent application WO/2021/217216.

Potential Commercial Applications

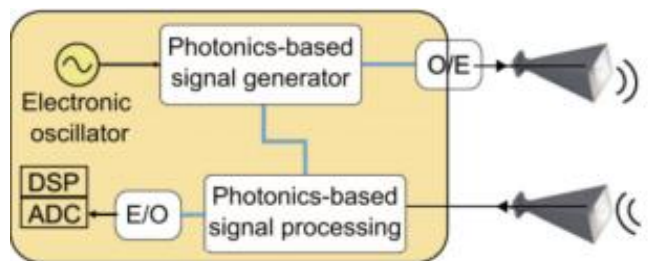
The photonics-based radar system offers applications in security inspection, internal testing, autopilot, and target identification, providing precise ranging and high spatial resolution. It operates at low-megahertz frequencies using optical electronics, enhancing performance while reducing costs and complexity.

Commercially, it finds use in synthetic aperture radar (SAR) imaging, ground penetrating radar (GPR), multiple-input and multiple-output (MIMO) radar, and biomedical monitoring.

Its capabilities extend to security systems, manufacturing, aerospace, defence, civil engineering, archaeology, and healthcare, improving safety, quality control, navigation, and situational awareness across various sectors.

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