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Editorial

Terahertz Technologies and Its Applications

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1. Introduction

The terahertz frequency range (0.1–10) THz has demonstrated the provision of many opportunities in various fields, such as high-speed communications, biomedicine, sensing, and imaging [1–6]. Historically, this frequency range, lying between the fields of electronics and photonics, was known as the "terahertz gap" because of the lack of sources, detectors and fabrication technologies.

However, considerable effort is now being devoted worldwide to improving this technology. Within this context, great progress has been made to fill the gap in this interesting spectral range, such as multiplexers and tuneable devices [7], among others. The aim of this Special Issue is to provide a platform to highlight the work being conducted within this range of the electromagnetic spectrum.

2. In This Special Issue

This Special Issue consists of thirteen papers covering a range of applications using THz technologies, including THz sensing and imaging, spectroscopy applications, and non-destructive testing. The contents of these papers are introduced below.

Reference [8] presents the modelling and evaluation of zero-biased Schottky diodes. Two different mounting techniques are considered: wire bonding and flip-chip. The experimental results are supported by numerical simulations demonstrating the validity of the proposed models. The improvement of radar cross-section using THz signals is shown and demonstrated in Reference [9], where the concept of adaptive gates is adopted to reduce the signal-to-noise ratio, thereby improving the accuracy of the measurement. The design of a frequency multiplier source working at 0.335 THz is reported in Reference [10] with two different schemes; experimental validations of the proposed designs are provided.

This Special Issue also includes applications in THz spectroscopy. In Reference [11], the authors propose a mechanism to improve the accuracy of optical delay lines for THz spectroscopy applications by using an optical encoder. In Reference [12], the authors demonstrate a radiation power improvement of almost four times for spiral photoconductive antennas. Analyses of the structures are carried out using THz time-domain spectroscopy. In Reference [13], it is shown how THz spectroscopy can be used for non-destructive testing of the hollowing deterioration of stone relics (Yungang Grottoes in this case). Further applications for non-destructive testing using THz radiation are presented in Reference [14], where an optimal scanning technique for honeycomb sandwich composite panels is proposed. THz spectroscopy is applied in Reference [15] to evaluate the vulcanization and macrodispersion of silica for rubber products using THz absorption measurements.

The design, study, and experimental demonstration of a biased sub-harmonic mixer working at a frequency of 0.67 THz is presented in Reference [16], demonstrating a conversion loss of 18.2 dB in the band between 0.650 THz and 0.690 THz. A synthetic aperture THz imaging technique based on the light field imaging system is proposed in Reference [17]. An on-chip THz detector is presented in Reference [18]; it is designed by using both an on-chip inset-feed rectangular patch antenna and a catadioptric lens. Reference [19] presents a nano displacement sensor using hetero-structure waveguides working in the THz frequency range of 0.8–1.1 THz, demonstrating a maximum sensitivity of around 1.2 GHz/μm.

A coupled stack oscillator working at 0.350 THz is presented in Reference [20], showing an output power of −0.8 dBm at 0.3532 THz.

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