applied sciences

MDPI

Editorial

Special Issue on New Trends in Telecommunications Engineering

Jaume Anguera [1,2]

[1] R&D Department at Ignion, 08190 Barcelona, Spain; jaume.anguera@salle.url.edu
[2] Smart Society Research Group, Universitat Ramon LLull, 08022 Barcelona, Spain

This collection of research papers explores various aspects of antenna design and high-speed wireless communication, delving into the forefront of technology for modern telecommunications. Antennas are crucial components in wireless systems, enabling the transmission and reception of data. The papers in this collection investigate innovative antenna designs that cater to the growing demands of future-generation wireless applications, including 5G networks, Internet of Things (IoT) devices, and ultra-wideband (UWB) communication.

These papers discuss antennas with characteristics such as super-wideband capabilities, dual-band operation, high gain, and multiple-input multiple-output (MIMO) configurations. Additionally, they explore novel techniques in order to minimize interference and optimize antenna layouts for improved performance. Furthermore, this collection delves into topics related to wireless communication efficiency, including error reduction methods and advanced optical nano-antenna designs for photonics applications. Overall, these papers represent the ongoing efforts to push the boundaries of antenna technology and enhance high-speed wireless communication systems for a connected and data-driven future.

A brief summary of the papers can be found below.

Ref. [1] paper proposes a high-dimension ratio, octagonal-shaped, super-wideband (SWB) monopole antenna. The antenna exhibits a frequency range of 3.71 to 337.88 GHz with good performance metrics such as $|S11| \leq -10$ dB, VSWR < 2, a bandwidth ratio (BR) of 91.07:1, and a very high bandwidth dimension ratio (BDR) of 6057.27. The antenna is designed on a Rogers 5880 dielectric substrate with compact dimensions of $14 \times 16 \times 0.787$ mm^3. The simulated and measured results show good agreement, making the antenna suitable for future-generation mobile networks due to its strong radiation properties, compactness, and extremely wide bandwidth.

Ref. [2] presents a design of an elliptical-shaped dual-band UWB notch antenna for wireless applications. The antenna incorporates corner cuts on a partial ground plane to achieve a UWB bandwidth and utilizes inverted-U-shaped and conductor-shaped resonators for dual-band notch characteristics. The proposed antenna has dimensions of 24×32 mm^2 and offers a gain of 4.9 dB, a bandwidth of 2.5–11 GHz, and a stable radiation pattern. It rejects WLAN and ITU bands from 5.2 to 5.7 GHz and 7.2 to 8.5 GHz, respectively. The article discusses the evolution stages of the UWB antenna and the parametric analysis of the UWB notch antenna.

Ref. [3] presents a compact antenna system with a multiple-input multiple-output (MIMO) configuration for mm-wave 5G-based Internet of Things (IoT) applications. The antenna elements are arranged to achieve significant field decorrelation and a dielectric layer is added to improve the radiation characteristics. The MIMO configuration has a size of 14 mm $\times$ 20 mm and operates in the frequency range of 16.7 to 25.4 GHz. It achieves a peak gain of 8.47 dB, more than 80% total efficiency, and high isolation of over -30 dB. The design demonstrates wideband features, improved gain, and high isolation, making it suitable for mm-wave-based 5G applications.

Citation: Anguera, J. Special Issue on New Trends in Telecommunications Engineering. *Appl. Sci.* **2023**, *13*, 9892. https://doi.org/10.3390/app13179892

Received: 21 August 2023
Accepted: 29 August 2023
Published: 31 August 2023

Ref. [4] explains a novel MIMO antenna system for ultra-wideband (UWB) applications is presented. The system consists of a 4 × 4 array of antenna elements arranged in a plus-shaped configuration. The individual antenna element is a fractal circular ring structure with a modified partial ground plane. It operates in the frequency range of 2.67 GHz to 12 GHz, with a wide impedance bandwidth of 9.33 GHz. The system provides pattern and polarization diversity without the need for any isolation enhancement network. The fabricated and tested MIMO antenna shows UWB response and good isolation between the antenna elements, making it suitable for UWB MIMO applications.

Ref. [5] proposes efficient helical and FRF interleavers for OFDM systems, enhancing reliability and throughput. The study compares FFT-OFDM with DWT-OFDM using various wavelet families and channel models. The results show DWT-OFDM outperforms FFT-OFDM, particularly with the Haar wavelet. The simulation indicates FRF interleaving improves the BER for FFT-OFDM, while DWT-OFDM's FRF interleaver performs similarly to the helical interleaver. The recommendation is to use FRF interleaving for FFT-OFDM, improving energy efficiency. Further research is needed to compare conventional interleavers with the proposed FRF interleaver.

Ref. [6] presents a broadband optical nano-antenna with a hybrid plasmonic feed, designed for nano-photonic applications. The antenna exhibits a gain of up to 11.4 dBi and covers a wide range of optical communication wavelengths. It features a unique hybrid plasmonic waveguide-based feed that enables directional radiation properties. The antenna is suitable for inter- and intra-chip optical communications and sensing applications. The study also explores array configurations to increase gain and directionality, making it useful for optical energy harvesting.

Ref. [7] presents the optimization of a coherent dual-beam array feed network for aperiodic concentric ring antennas. The feeding system is based on a reconfigurable topology with alternated power dividers and combiners, providing coherent in-phase outputs. The study analyzes a two-beam architecture with multi-beam shaping and steering features, and optimizes the aperiodic layout based on the radii of the circular rings using the differential evolution method. The numerical experiments validate the improved performance of the proposed dual-beam configuration with a non-uniform layout compared to its uniform counterpart. The results show an enhanced performance in terms of sidelobe level and directivity.

Ref. [8] studies a compact concentric structured wideband antenna with triple notch bands was designed and experimentally demonstrated. The antenna exhibited a broad impedance bandwidth of 45.83 GHz (1.67–47.5 GHz) with three notches at 1.8–2.2 GHz, 4–7.2 GHz, and 9.8–10.4 GHz to minimize interference from the AWS, C, and X bands, respectively. The simulated and measured results of the VSWR, gain, and radiation pattern showed good agreement. The antenna also demonstrated excellent time-domain characteristics, including minimal pulse distortion and constant group delay. A comparative analysis with existing designs showed that the proposed antenna outperformed in terms of bandwidth, gain, and rejection levels. Overall, the designed antenna is a promising solution for pulse-based wideband communication systems.

Ref. [9] describes a modified Franklin array antenna for 5G wireless applications operating at 22.7 and 34.9 GHz. The antenna consists of a 3 × 3 array patch element and a slotted ground plane, designed for broad bandwidth, high directivity, and dual-band operation. The dimensions of the patch antennas are based on $\lambda/2$ of the second resonant frequency. The simulation and measurement results show a dual-band operation with good impedance bandwidth. The antenna performance is analyzed through parametric analysis, and the design is carried out using HFSS v.14.0. The proposed antenna overcomes the limitations of previous collinear arrays and Franklin antennas, offering wideband operation, a compact size, and improved performance.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Suguna, N.; Revathi, S. A Compact Super-Wideband High Bandwidth Dimension Ratio Octagon-Structured Monopole Antenna for Future-Generation Wireless Applications. *Appl. Sci.* **2023**, *13*, 5057. [CrossRef]
2. Kumar, O.P.; Ali, T.; Kumar, P.; Kumar, P.; Anguera, J. An Elliptical-Shaped Dual-Band UWB Notch Antenna for Wireless Applications. *Appl. Sci.* **2023**, *13*, 1310. [CrossRef]
3. Sehrai, D.A.; Asif, M.; Khan, J.; Abdullah, M.; Shah, W.A.; Alotaibi, S.; Ullah, N. A High-Gain and Wideband MIMO Antenna for 5G mm-Wave-Based IoT Communication Networks. *Appl. Sci.* **2022**, *12*, 9530. [CrossRef]
4. Alharbi, A.G.; Rafique, U.; Ullah, S.; Khan, S.; Abbas, S.M.; Ali, E.M.; Alibakhshikenari, M.; Dalarsson, M. Novel MIMO Antenna System for Ultra Wideband Applications. *Appl. Sci.* **2022**, *12*, 3684. [CrossRef]
5. El-Fouly, F.H.; Ramadan, R.A.; Abd El-Samie, F.E.; Kachout, M.; Alzahrani, A.J.; Alshudukhi, J.S. Burst Channel Error Reduction Based on Interleaving for Efficient High-Speed Wireless Communication. *Appl. Sci.* **2022**, *12*, 3500. [CrossRef]
6. Ahmad, I.; Ullah, S.; Din, J.U.; Ullah, S.; Ullah, W.; Habib, U.; Khan, S.; Anguera, J. Maple-Leaf Shaped Broadband Optical Nano-Antenna with Hybrid Plasmonic Feed for Nano-Photonic Applications. *Appl. Sci.* **2021**, *11*, 8893. [CrossRef]
7. Arce, A.; Stevens-Navarro, E.; Pineda-Rico, U.; Cardenas-Juarez, M.; Castillo-Soria, F.R.; Covarrubias, D.H. Optimization of a Coherent Dual-Beam Array Feed Network for Aperiodic Concentric Ring Antennas. *Appl. Sci.* **2021**, *11*, 1111. [CrossRef]
8. Balani, W.; Sarvagya, M.; Ali, T.; Samasgikar, A.; Das, S.; Kumar, P.; Anguera, J. Design of SWB Antenna with Triple Band Notch Characteristics for Multipurpose Wireless Applications. *Appl. Sci.* **2021**, *11*, 711. [CrossRef]
9. Surendran, A.; Ali, T.; Kumar, O.P.; Kumar, P.; Anguera, J. A Dual-Band Modified Franklin mm-Wave Antenna for 5G Wireless Applications. *Appl. Sci.* **2021**, *11*, 693. [CrossRef]