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Editorial: Advanced signal processing techniques in radiation detection and imaging

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Editorial on the Research Topic
Advanced signal processing techniques in radiation detection and imaging

With the continuous evolution of the electromagnetic environment, there is a growing demand for efficient, high-precision, and high-resolution radiation detection and imaging technologies in various fields. At the same time, system requirements for interference suppression and accurate target detection in complex environments are also increasing. Therefore, there is an urgent need to promote theoretical and technological innovations in the fields of electromagnetism and signal processing to enhance the system's ability to acquire information. This Research Topic focuses on the detector imaging mechanism, imaging data processing, and high-resolution reconstruction, with special emphasis on radiation detection data processing and algorithm development, hardware and software synergy and intelligent processing, accurate measurement of target and environment characteristics, target classification and identification, and adaptability to complex electromagnetic environments in wireless engineering systems.

In the field of antenna and signal processing technology, *Direction and distribution sensitivity of sup-DOF interference suppression for GNSS array antenna receiver* by Sun et al. focuses on the anti-jamming capability and mechanism of Global Navigation Satellite System (GNSS) array antenna against distributed sup-DOF (Degree of Freedom) interference, and analyses the characteristics of GNSS System array antenna against sup-Degree of Freedom interference by formula derivation and simulation. Qiu et al. *Artifact suppression using cross-circular polarization for millimeter-wave imaging* proposes a cross-polarization method to suppress multipath artifacts. *Performance analysis of SMI filter for antenna array receiver in pulse interference environment* by Wang et al. analyzes the performance of sample matrix inversion (SMI) filter used by antenna array receivers in pulse interference environment. *Ultimate channel capacity analysis of the UCA-OAM system with a deficient-rank channel matrix* by Yu et al. investigates the channel capacity analysis of deficient-rank channel (DRC) matrix in uniform circular array (UCA) communication systems. *A novel SW-ESIW slot antenna and its applications in millimeter-wave array design* by Qiang et al. proposes a novel slot antenna structure with high gain and compact size for millimeter-wave (mmW) applications, which is the first attempt to apply slow-wave substrate-integrated waveguide (SW-ESIW) to the field of antennas and their arrays.

In the field of communication satellites and interference detection technologies, *A survey of GNSS interference monitoring technologies* by Qiao et al. summarizes the interference monitoring technologies and their latest progress, and emphasises the breadth of integration of interference monitoring technologies with other fields, which has led to their rapid development. *A novel method of interference source direction-finding with an existing single antenna beam in communication satellites* by Ma et al. introduces a method for detecting interference sources for communication satellites with an existing single antenna beam and single radio frequency (RF) channel.

Regarding the research on GNSS and satellite links, *Impact of ambiguity resolution on phase center offsets and hardware delay estimation for BDS-3 inter-satellite links* by Li et al. presents for the first time the impact of ambiguity resolution on phase center offsets (PCOs) and hardware delay estimation of BDS-3 inter-satellite links. Focusing on real-time precise orbit determination for GNSS satellites, *An improved approach for rapid filter convergence of GNSS satellite real-time orbit determination* by Zhou et al. proposes a method to establish the stochastic model by analyzing the differences between the predicted part of the ultra-rapid orbit and the filter orbit after convergence.

Regarding electromagnetic interference filtering techniques, *Wideband electromagnetic interference filtering power divider with a wide stopband using the genetic algorithm* by Dai et al. proposes a new design of an electromagnetic interference wideband filtering power divider (FPD) with a wide stopband based on the genetic algorithm (GA), which has the good performance of compact size, sharp roll-off and in-band isolations.

For microwave radiation technology, *A geostationary orbit microwave multi-channel radiometer* by Zhou et al. introduces a geostationary orbit microwave multi-channel radiometer for fine and quantitative applications of satellite observation data.

In the field of radar jamming signal processing, *Adaptive Optimization Technology of Segmented Reconstruction Signal based on Genetic Algorithm for Enhancing Radar Jamming Effect* by Wang et al. focuses on the adaptive optimisation of jamming waveforms for radar jamming technology to suppress multiple false targets in the escort jamming scenarios.

In conclusion, this Research Topic focuses on the convergence of applications in the fields of electromagnetism and signal processing, presenting readers with the latest scientific achievements and technological innovations. This research not only enriches and provides the body of knowledge in related fields, but also provide new directions and possibilities for future research and applications. We look forward to more researchers actively engaging in these fields and jointly promoting the advancement of technology and the expansion of applications.

Author contributions

JD: Writing–original draft, Writing–review and editing. ZL: Writing–review and editing. YC: Writing–review and editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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