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Preface of Special Issue on Wireless Communications

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The continuous evolution of wireless communication technologies is playing a pivotal role in enabling intelligent, connected, and data-driven systems across diverse application domains. This special issue brings together a collection of high-quality research contributions that address recent advances in wireless communications, spanning theoretical analysis, emerging technologies, system design, and real-world applications.

A major focus of this issue is on the performance limits and optimization of next-generation wireless networks. Several contributions investigate multi-user communication scenarios, including the achievable rate region of wireless multiple access channels assisted by unmanned aerial vehicle (UAV) relays with multiple independent transmitters. Complementing this, the study of upper bounds on the average achievable rate of non-orthogonal multiple access (NOMA) systems provides valuable insights into the spectral efficiency limits of future communication paradigms. Further advancements are presented in massive multiple-input multiple-output (MIMO) and millimeter-wave (mmWave) systems, where novel channel estimation techniques based on coherence-optimized measurement matrices are proposed, alongside performance analysis of local processors-assisted cell-free massive MIMO (CF-mMIMO) systems. These works collectively contribute to improving capacity, reliability, and scalability in modern wireless networks.

In addition, this special issue highlights emerging technologies that are shaping intelligent wireless environments. In particular, the integration of reconfigurable intelligent surfaces (RIS) with minimum redundancy linear arrays (MRLAs) for high-precision direction-of-arrival (DOA) estimation demonstrates significant potential in enhancing spatial resolution and signal detection for closely spaced targets. Complementary to these advances, the design and implementation of a wideband antenna capable of simultaneous transmission and reception with improved isolation addresses key challenges in full-duplex communication systems, further advancing hardware capabilities for next-generation networks.

Beyond theoretical and physical layer innovations, the issue also emphasizes the growing role of wireless communication in enabling smart and sustainable applications. Contributions on blockchain-enabled Internet of Things (IoT) frameworks for smart farming and IoT-based automated watering systems for smart gardens illustrate how integrated wireless and computing technologies can enhance efficiency, resource management, and automation in agricultural environments.

Security and resilience of wireless systems are also key themes addressed in this issue. A centralized machine learning-based intrusion detection system for mitigating distributed denial-of-service (DDoS) attacks in wireless sensor networks (WSNs) is presented, highlighting the importance of intelligent security mechanisms in protecting modern communication infrastructures.

Finally, recognizing the broader societal impact of wireless technologies, this issue includes a comprehensive review of radio frequency electromagnetic wave effects on human health and reproduction. This work provides critical insights into safety considerations, emphasizing the need for responsible deployment of wireless systems.

In summary, the papers featured in this special issue collectively provide a comprehensive perspective on current research directions in wireless communications, encompassing theoretical foundations, enabling technologies, practical applications, and societal implications. We hope this collection will serve as a valuable resource for researchers, engineers, and practitioners, and will inspire further innovations in this rapidly evolving field.

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