Editorial: Won5G: New Waveform, Non-Orthogonal Multiple Access, and Networking for 5G

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Editorial:

Mobile/wireless communications and networking deeply influence human lives, while rapid growth in wireless networking also dramatically stimulates the mobile demands. Currently, the fifth generation (5G) mobile communication system is being studied and standardized worldwide. 5G asks for 1000 times system capacity, 10 times spectral efficiency, higher data rates (the peak data rate of 10 Gbps and the minimum guaranteed user data rate of 100Mbps), very large volume of connections (1 million connections per sq.km), and ultra-low latency (radio latency less than 1 ms and E2E latency less than 10 ms). Unsurprisingly, there are strong demands on a series of new techniques supporting these challenging expectations.

Recently, some of the most promising approaches for 5G are emerging. Some new types of waveforms are proposed to flexibly accommodate diversified services or applications with different requirements. By introducing new resource domains to separate multi-users, non-orthogonal multiple access can serve more users in the same frequency and time resource block, which significantly improves the capacity, connections, and spectral efficiency. Several non-orthogonal multiple access approaches have been proposed, such as NOMA in power, sparse code multiple access (SCMA) in code domain, multi-user shared access (MUSA), pattern division multiple access (PDMA), lattice partition multiple access (LPMA), and interleave division multiple access (IDMA). Moreover, to further address the extremely high capacity requirements, ultra-dense heterogeneous networking is considered as a promising

architecture for 5G. Especially, providing high capacity and connections through directional transmission and large bandwidth, millimeter wave (mmWave) communications and networking will attract increasing attentions. However, there are still a series of technical problems need to be addressed.

This special issue features six selected papers with high quality. The first article, “Power Control based Multiuser Full-Duplex (FD) MAC Protocol for the Next Generation Wireless Networks”, proposes a power control based multiuser FD MAC protocol, named PC MU-FuPlex. By jointly considering full-duplex and power control, the authors design the detailed PC MU-FuPlex MAC Protocol based on the framework of IEEE 802.11ax and analyze probability of establishing FD link.

The second article titled “Optimum Ultra-Reliable and Low Latency Communications in 5G New Radio” faces to the ultra-reliable and low latency demands in 5G, and presents a multi-armed bandit (MAB) based reinforcement learning approach to achieve the optimum harmonization of feedback and feedbackless transmissions.

Non-Orthogonal Multiple Access (NOMA) is one of the most promising technologies in 5G. In the third article with the title “Rateless coding based incremental redundancy HARQ scheme for SCMA systems”, the authors present a rateless coding based incremental redundancy (IR) HARQ scheme for sparse code multiple access (SCMA) systems over fading channels, where each user is assumed to use rateless codes.

The fourth article titled “Case Study and Performance Evaluation of MDMA - A Non-Orthogonal Multiple Access Scheme for 5G Cellular Systems” demonstrates the feasibility and realizability of the multipath division multiple access (MDMA) cellular system, and describes the receiver operation in detail.

The fifth article, “Characterizing the Capability of Vehicular Fog Computing in Large-scale Urban Environment” focuses on the vehicular fog computing in large-scale urban environment. The authors characterize the computational capability of vehicular fog computing in a practical scenario, and further propose a time-varying graph model to assess the capability of vehicular fog computing.

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The last article titled “Design in Power-Domain NOMA: Eavesdropping Suppression in the Two-User Relay Network with Compensation for the Relay User” considers the power domain NOMA. The authors propose a novel signal-level scheme named ESICOR to achieve eavesdropping suppression for the indirect communication user with the compensation for the relay user.

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