Guest Editorial
Next-Generation CDMA Technologies

THE GREAT success of the Internet and mobile cellular communications has opened a new vista for future all-IP wireless applications, and has been shown in continuously increasing demand for worldwide packet data services in the current 2.5G and 3G networks. It is expected that the future wireless systems will be operating based mainly if not completely on burst data services to carry multimedia traffics, which will include voice, data, image, and video. The need to support such a great amount of burst-type traffic in wireless channels has already posed a major challenge to all currently available radio air-link technologies based on either time-division multiple access (TDMA) or code-division multiple access (CDMA). There are many ongoing debates in the community on which type of multiple access technologies will be most suitable for the B3G wireless. It has been suggested that the current CDMA technologies (all based on direct sequence CDMA, such as IS-95A/B, cdma2000, UMTS-UTRA, W-CDMA, TD-SCDMA, etc.) are suited only for slow-speed continuous-transmission applications such as voice, but may not be suitable for high-speed burst-type traffic, which will be dominating in future all-IP 4G wireless. Therefore, new research initiatives are necessary to develop next-generation CDMA technologies, which should effectively address all the problems existing in the current CDMA technologies, such as very low spreading efficiency (measured by bits carried by each chip), strictly interference-limited capacity, inefficient rate-matching algorithms, the needs for precision power control, etc. The study on the next-generation CDMA technology involves many cutting-edge research topics, such as novel spreading codes/sequences design, efficient spreading modulation schemes, multidimensional array spreading, multiple-input–multiple-output (MIMO) and orthogonal frequency-division multiplexing (OFDM) technologies, and innovative CDMA air-link signaling designs. The short-term objective for this research is to look for new CDMA technologies, which could effectively enhance overall bandwidth efficiency and detection efficiency, and fit the applications of the future all-IP wireless systems. The ultimate goal of this research, however, is to engineer an ideal CDMA architecture whose capacity should no longer be limited by interference. This Special Issue serves as a stimulus to accelerate technological evolution of CDMA technologies for futuristic B3G wireless applications.

It has to be noted that the Call for Papers for this issue received an overwhelming response from the research community. About 80 high-quality submissions were received from both academia and industry from different regions around the world. This is a very positive sign to show that people in the world have been aware of the importance of the research topics covered in this Special Issue. Due to very limited page budget herein, we unfortunately could accept only 21 papers, which were the survivors from a rigorous review process.

This Special Issue covers five important research topics on next-generation CDMA technologies, which include CDMA resource allocation issues (six papers), CDMA sequences design (four papers), space–time/turbo coded CDMA (four papers), chip-interleaving CDMA (two papers), and CDMA equalizer/MUD algorithms (five papers). Due to a very limited page budget in this issue, we should omit introducing the major content of each paper, but only list their titles and their authors as follows.

CDMA Resource Allocation

1) "Quality-of-Service Provisioning and Efficient Resource Utilization in CDMA Cellular Communications" by Jiang *et al.*
2) "A Novel Dynamic Cell Configuration Scheme in Next-Generation Situation-Aware CDMA Networks" by Liao *et al.*
3) "Call Admission and Code Allocation Strategies for WCDMA Systems with Multirate Traffic" by Cruz-Pérez *et al.*
4) "An Analysis of VoIP Service Using 1×EV-DO Revision A System" by Bi *et al.*
5) "A Dynamic Resource Allocation Scheme for Delay-Constrained Multimedia Services in CDMA 1×EV-DV Forward Link" by Ci *et al.*
6) "Capacity of Future WCDMA Networks Supporting Multimedia Services" by Elshabrawy and Le-Ngoc.

CDMA Sequences Design

7) "Generalized Pairwise Complementary Codes With Set-Wise Uniform Interference-Free Windows" by Chen *et al.*
8) "Transform Domain Approach for Sequence Design and Its Applications" by Tsai and Su.
9) "Design of Spreading Codes for Quasi-Synchronous CDMA with Intercell Interference" by Tang and Mow.
10) "Transmitter Adaptation Algorithm for Multicellular Synchronous DS-CDMA Systems With Multipath" by Cotae.

Space–Time/Turbo Coded CDMA

11) "Transmit Selection Diversity With Maximal-Ratio Combining for Multicarrier DS-CDMA Wireless Networks Over Nakagami-m Fading Channels" by Tang and Zhang.
12) "Optimal Linear Space–Time Spreading for Multiuser MIMO Communications" by Wang and Wang.

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13) "MIMO Assisted Space-Code-Division Multiple-Access: Linear Detectors and Performance Over Multipath Fading Channels" by Yang.
14) "Downlink Transmission of Broadband OFCDM Systems—Part III: Turbo-Coded" by Zhou *et al.*

Chip-Interleaving CDMA

15) "Analysis and Optimization of CDMA Systems With Chip-Level Interleavers" by Liu *et al.*
16) "Pilot-Aided Chip-Interleaved DS-CDMA Transmission Over Time-Varying Channels" by Na *et al.*

CDMA Equalizer/MUD Algorithms

17) "Packet Access Using DS-CDMA With Frequency-Domain Equalization" by Garg and Adachi.
18) "Bidirectional Iterative ISI Canceller for High-Rate DSSS/CCK Communications" by Kim.
19) "Code-Aided Joint Channel and Frequency Offset Estimation for DS-CDMA" by Guenach *et al.*
20) "Covariance-Based Linear Precoding" by Zerlin *et al.*
21) "Iterative Reduced-Complexity Multiuser Detection Based on Chase Decoding for Synchronous Turbo-Coded CDMA System" by Qin and Teh.

We hope that by highlighting some of the current work covered in all papers in this issue on the design of next-generation CDMA technologies for B3G wireless communications, the researchers could be encouraged to consider some specific research topics raised here. We hope this issue will trigger further interest in the above research areas.

We would like to take this opportunity to express our gratitude to all those dedicated authors who submitted their quality papers to this issue. Without their support, the success of this JSAC issue would not have been possible. We would also like to thank numerous anonymous reviewers who helped us to carry out their thoughtful reviews in the most professional manner. Finally, we want to also express our gratitude to the Editor-in-Chief, N. Maxemchuk, and the Senior Editor, L. Milstein, for their generous support and instructions, as well as other IEEE Publications Staff, S. McDonald, J. Cichocki, and P. M. Pena for their cordial help throughout the entire review (which was really a great challenge to finish reviewing such a great number of submissions) and publication process.

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