Hindawi
Wireless Communications and Mobile Computing
Volume 2019, Article ID 9790853, 2 pages
https://doi.org/10.1155/2019/9790853

Editorial

Advanced Wireless Technology for Ultrahigh Data Rate Communication

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Received 13 February 2019; Accepted 13 February 2019; Published 4 March 2019

According to a strong demand for high-speed services in various 5G deployment scenarios, the key performance requirements for IMT-2020 (5G technical specification) have included the peak data rate of 20 Gbps in downlink and 10 Gbps in uplink as well as the user experienced data rate of 100 Mbps in downlink and 50 Mbps in uplink, and then greatly higher target performance can be intuitively expected for beyond-5G. The main challenges to realize such high data rate are to fully exploit the radio resources (e.g., time, frequency, space, power, and polarization), fully cooperate with other transmitters or receivers, and fully utilize microwave and millimeter-wave spectrum. In practice, these challenges may be restricted by the availability of radio resources and collaborative transmitters or receivers, the capability of transceiver, the accuracy of available channel state information, and so on.

For the past decade, attractive wireless technologies have been presented to fulfill high data rate. The representative technologies involve digital/analog beamforming, multihop transmission, coordinated multipoint transmission/reception, nonorthogonal multiple access, massive multiple-input-multiple-output (MIMO), cognitive radio, millimeter-wave, and so on. However, an independent use of these technologies has induced a limit to improvement in achievable data rate, which has encouraged many researchers to focus on combining and optimizing the wireless technologies so as to extremely enhance the data rate. Although numerous combined technologies for further performance improvement have been proposed up to the present, more innovative combination and optimization should be consistently studied as the target performance for the next-generation communication becomes continuously improved.

Furthermore, the real wireless communication environments, in particular, regarding 5G New Radio and beyond-5G, introduce new practical issues in implementing the combined and optimized wireless technologies as follows: channel estimation capability with the associated reference signal design, transmission/reception collaboration capability, transmitter/receiver complexity, channel state information feedback, MIMO beamforming codebook design, new waveforms, wireless channel characteristics, and so on. Hence, the practical issues in the implementation of technology need to be addressed with the research on advanced wireless technology. In this context, the accepted papers to be published are focused on combining and/or optimizing the wireless technologies to enhance the achievable data rate, covering both theoretical, and implementation aspects.

The first paper "Development and Validation of New Reverberation Chamber for Wireless Devices" by D.-U. Sim *et al.* has proposed a reverberation chamber (RC) structure with new reflectors and mode stirrers for electromagnetic compatibility and wireless terminal measurements. The main parameters for the reflectors and mode stirrers have been determined through a logical approach based on standard deviation and eigenfrequency shift analysis by 3D simulations. It has been shown that the proposed RC design method is an effective solution to predict the actual measured results, satisfying all of the requirements defined. Consequently, it is expected that the performance of the proposed RC could be a highly effective solution to measure and evaluate the performance of commercial wireless terminals.

The second paper "Spatiotemporal Statistical Channel Model for Indoor Corridor at 14 GHz, 18 GHz, and 22 GHz Bands" by N. O. Oyie and T. J. O. Afullo has proposed a measurement-based channel model considering both delay and angular domains of an indoor corridor channel. For the cluster identification purpose at different frequency bands, a nonparametric Gaussian kernel density estimation (KDE) method is exploited. The authors have proposed a spatiotemporal model assuming dependence in delay and spatial domains and have presented the proposed model under characterization parameters. It has been demonstrated that both clusters and multipath components can be, respectively, estimated by probability density functions following Gaussian and Laplacian fits in the spatial domain for indoor corridor environments.

The third paper "Robust Shrinkage Range Estimation Algorithms Based on Hampel and Skipped Filters" by C.-H. Park and J.-H. Chang has investigated robust shrinkage range estimation algorithms using Hampel filter, skipped filter, PBM, and BS estimators. The concepts of robustness for the Hampel filter and skipped filter have been combined with shrinkage for the positive blind minimax and Bayes shrinkage estimation. The performance of the proposed schemes in terms of the mean square error (MSE) is substantially improved beyond that of conventional median-based shrinkage algorithms. Further, the proposed algorithms can be represented in a closed-form expression, which guarantee lower complexity compared to the iteration-based methods.

The fourth paper "Implementation and Field Trials of OFDM-Based Digital Video Broadcasting System in Commercial Broadcasting Network for Multichannel UHD Service" by S.-J. Ra *et al.* has presented an OFDM-based digital video broadcasting system test platform for multichannel ultrahigh definition (UHD) broadcasting services. Measured by a commercial STB and signal analyzer, the authors have observed that the implemented OFDM-based digital video broadcasting transmitter can achieve the 51.6 Mbps transmission rate for multichannel UHD broadcasting services. Furthermore, the authors have presented received signal spectrum, BER performance, and CNR of 4096QAM related to the performance and physical network status. These test results can better guide OFDM-based digital video broadcasting technology in many countries and the development of a next-generation digital broadcasting system.

The fifth paper "Outage Analysis of User Pairing Algorithm for Full-Duplex Cellular Networks" by H.-H. Choi and W. Noh has delved into a user pairing problem to minimize outage probability and formulated it as a nonconvex optimization problem in a full-duplex (FD) cellular network. The authors have proposed a low-complexity algorithm in a way that the uplink (UL) user reduces its transmit power to satisfy the SINR threshold for minimizing the interuser interference and the downlink (DL) user with a worse signal quality preferentially selects its UL user who gives less interference for outage minimization. Using stochastic geometry, the performance of the user pairing algorithm has been analyzed. Both simulation and analysis have indicated that the proposed scheme can vastly reduce the interuser interference and enhance the DL outage performance while satisfying the requirement of UL signal-to-interference-plus-noise ratio. Therefore, the results in this paper can be exploited for the protocol design and implementation of the future FD cellular network.

The sixth paper "Performance Evaluation of IEEE 802.11ad in Evolving Wi-Fi Networks" by K. Nguyen *et al.* has presented an experimental study on IEEE 802.11ad links in a typical indoor environment with different network and interference conditions. The measured results have shown that off-the-shelf IEEE 802.11ad hardware can achieve the Gbps-level throughput of the transmission control protocol (TCP) and user datagram protocol (UDP) under the constraints of signal strength, MCSs, and MTUs. In addition, to mitigate the link maintenance issue, they have proposed using MPTCP for a fast switchover between an IEEE 802.11ad to a legacy Wi-Fi link, which has been evaluated through experiments.

Conflicts of Interest

The guest editorial team declares that they do not have any possible conflicts of interest or private agreement with companies regarding the special issue for Wireless Communications and Mobile Computing.

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