

Editorial

Millimeter-Wave Wireless Communication Systems: Theory and Applications

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Recently, millimeter-wave radio has attracted a great deal of interest from academia, industry, and global standardization bodies due to a number of attractive features of millimeter-wave to provide multi-gigabit transmission rate. This enables many new applications such as high definition multimedia interface (HDMI) cable replacement for uncompressed video or audio streaming and multi-gigabit file transferring, all of which intended to provide better quality and user experience. Despite of unique capability of millimeter-wave technology to offer such a high data rate demand, a number of technical challenges need to be overcome or well understood before its full deployment. This special issue is aimed to provide a more thorough understanding of millimeter-wave technology and can be divided into three parts. The first part presents the recent status and development of millimeter-wave technology and the second part discusses various types of propagation channel models. Finally, the last part of this special issue presents some technical challenges with respect to suitable millimeter-wave air interface and highlights some related implementation issues.

In the first paper by S.-K. Yong and C.-C. Chong, the authors provide a generic overview of the current status of the millimeter wave radio technology. In particular, the potential and limitations of this new technology in order to support the multi-gigabit wireless application are discussed. The authors envisioned that the 60 GHz radio will be one of the important candidates for the next generation wireless systems. This paper also included a link budget study that highlights the crucial role of antennas in establishing a reliable communication link.

The second paper by N. Guo et al. extends the overview discussion of the first paper by summarizing some recent

works in the area of 60 GHz radio system design. Some new simulation results are being reported which shown the impact of the phase noise on the bit-error rate (BER). The authors concluded that phase noise is a very important factor when considering multi-gigabit wireless transmission and has to be taken into account seriously.

In the third paper by C.-P. Lim et al. the authors propose a 60 GHz indoor propagation channel model based on the ray-tracing method. The model is validated with measurements conducted in indoor environment. Important parameters such as root mean square (RMS) delay spread and the fading statistics in order to characterize the behavior of the millimeter-wave multipath propagation channel are extracted from the measurement database. This ray-tracing model is particularly important in characterizing the multipath channel behavior of various types of indoor environments, which are the typical application scenarios for 60 GHz technology.

The fourth paper by H. Yang et al. uses a different modeling approaches in characterizing the 60 GHz propagation channel. In this paper, a statistical-based channel model is proposed based on the extensive measurements campaign conducted in indoor office environment. Based on this, a single-cluster power delay profile (PDP) is found to best characterize the channel statistics in which the PDP can be parameterized by K-factor, RMS delay spread, and shape parameter under both line-of-sight (LOS) and non-LOS (NLOS) conditions. Various types of antenna beam patterns such as omnidirectional, fan-beam and pencil-beam, and their directivities are being investigated at both the transmitter and receiver sides. Finally, in order to analyze the effect of multipath channel on system design, an OFDM-based

system is used to compare the BER performance of both measured and modeled channels. The authors conclude that the directive configurations can provide additional link margins and improved BER performance for multi-gigabit transmissions using the 60 GHz radio technology.

The fifth paper by V. Kvicera and M. Grabner investigated the effect of rain attenuation at 58 GHz based on the large measurement results collected over a 5-year period. The measurement results obtained were analyzed and compared to the ITU-R recommendations which are valid for estimating long-term statistics of rain attenuation for frequency up to 40 GHz. The results reported are important as an extension to the ITU-R recommendations for realistic link-level analysis especially for point-to-point fixed system up to 60 GHz.

In the context of the wide deployment of 60 GHz links, the sixth paper by H. T. van der Zanden et al. addresses the modeling and prediction of rain-induced bistatic scattering at 60 GHz. This factor is important as it could cause link interference between nearby 60 GHz links when rain falls. The paper shows that despite of the high oxygen attenuation, coupling between adjacent links caused by bistatic scattering could be significant even in light rain.

The seventh paper by J. Nsenga et al. is related to the baseband system design in which two new modulation schemes, firstly, offset quadrature phase shift keying (OQPSK) with frequency domain equalization (FDE), and secondly, constant phase modulation (CPM) with time domain equalization. Both techniques are targeted for low-cost and low-power 60 GHz communications systems and are evaluated and compared by considering the effects of front end non-ideality. The authors found that OQPSK with FDE and non-fractional sampling minimum mean square error (MMSE) receiver yields best tradeoffs between BER performance and system complexity study in terms of analog-digital-converter (ADC) clipping and quantization effect, phase noise effect, as well as power amplifier nonlinearity effect.

In the eighth paper, by A. Mohammadi et al. a direct conversion modulator-demodulator for fixed wireless applications is proposed. The circuits consist of even harmonic mixers (EHMs) realized with antiparallel diode pairs (APDPs), where self-biased APDP is used in order to flatten the conversion loss of the system versus local oscillator (LO) power. The impacts of I/Q imbalances and DC offsets on BER performance of the system is also being considered. A communication link is built with the proposed modulator-demodulator and the experimental results shown that such a system can be a low-cost and high-performance 16-QAM transceiver especially for the local multipoint distribution system (LMDS) applications.

The last paper by S. O. Tatu and E. Moldovan proposed a practical circuit for the 60 GHz radio. In this paper, a V-band receiver using an MHMIC multipoint circuit is proposed. It was demonstrated that the combination of multipoint circuit with power detectors and two differential amplifiers can replace the conventional mixer in a low-cost heterodyne or homodyne architecture. The operating principle of the proposed heterodyne receiver and demodulation results of

high-speed MPSK/QAM signals are also discussed. Simulation results in the paper shown that an improved overall gain can be obtained. The authors concluded that such a multipoint heterodyne architecture can enable the compact and low-cost millimeter-wave receivers for the future wireless communications systems such as the IEEE 802.15.3c wireless personal area networks (WPAN) applications.

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Special Issue on

Signal Processing for Applications in Healthcare Systems

Call for Papers

The cost of medical- and healthcare has been skyrocketing over the past decades. This is mainly due to the rapid growth of the aging population. To provide more comfortable and effective healthcare services, a recent trend of healthcare has been directed towards de-institutionalization, community care, and home care. On the other hand, the technologies have witnessed an impressive evolution in signal/image processing, computers, and network communications. These technologies have facilitated the development of effective signal processing techniques in consumer electronics to improve the quality of community and home healthcare as well as many portable devices with a wide variety of applications where signal processing-based software plays a pivotal role in their success. The goal of this special issue is to provide most up-to-date and recent advances of signal processing techniques developed for system and network design of healthcare applications. Hopefully, this special issue will serve as a forum and venue for researchers in both academia and industries working in this fascinating and emerging area to share their experience and findings with the readers.

Major topics of interest include but are not limited to the following:

- Computer-aided diagnosis for various medical modalities
- Signal processing for vital signs monitoring and analysis
- Signal analysis in circuits and devices design for healthcare systems
- Signal processing and analysis in surveillance and home monitoring for healthcare systems
- Embedded system design for healthcare devices

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| Manuscript Due | December 1, 2007 |
| First Round of Reviews | March 1, 2008 |
| Publication Date | June, 2008 |

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2008 IAPR Workshop on Cognitive Information Systems

June 9-10, 2008, Santorini, Greece

Sponsored by the Intl. Association for Pattern Recognition
in Cooperation with EURASIP and IEEE

Call for Papers

This first workshop on **Cognitive Information Systems** (CIS) aims at bringing together researchers from the machine learning, pattern recognition, signal processing, and communications communities in an effort to promote and encourage cross-fertilization of ideas and tools. The focus of the first CIS workshop will be on Cognitive Radios.

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The first workshop will take place in one of the world's most beautiful and impressive places, the Greek island of Santorini.

The workshop is sponsored by the International Association for Pattern Recognition (IAPR) and in particular the Signal Analysis and Machine Intelligence Technical Committee. The workshop will feature keynote addresses and technical presentations all of which will be included in the registration. Papers are solicited for, but not limited to, the following areas:

- Learning theory and modelling
 - Bayesian learning and models
 - Graphical and kernel methods
 - Adaptive learning algorithms
 - Ensembles: committees, mixtures, boosting, etc.
 - Data representation and analysis: PCA, ICA, CCA, etc.
 - Other related topics
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- Cognitive radios
 - Cognitive component analysis -- Blind source separation, ICA, etc.
 - Cognitive dynamic systems
 - Distributed, cooperative, and adaptive processing
 - Other related topics

Plenary Speakers:

Prof. Simon Haykin (MacMaster Univ., Canada)
Prof. Jose Principe (Univ. of Florida, USA)
Prof. Ali Sayed (Univ. Of California, USA)
Prof. Bernhard Scholkopf (Max Plank Inst., Germany)

Schedule

Submission of full paper:
January 5, 2007

Notification of acceptance:
March 5, 2007

Camera-ready paper
and author registration:
March 15, 2007

CIS'2008 webpage: <http://cis2008.di.uoa.gr/>

Paper Submission Procedure

Prospective authors are invited to submit a double column paper of up to six pages using the electronic submission procedure described at the workshop homepage. Accepted papers will be published in a bound volume by the IEEE after the workshop and a CDROM volume will be distributed at the workshop.

